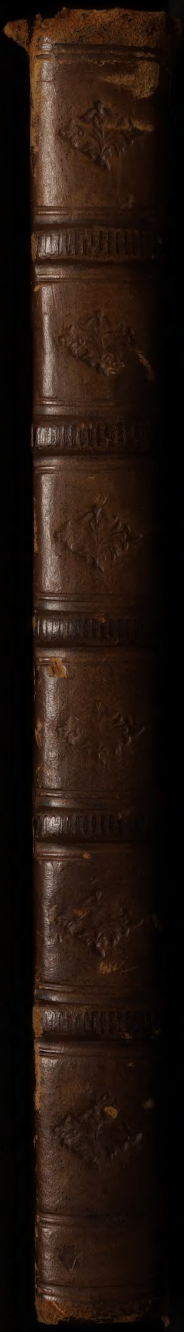
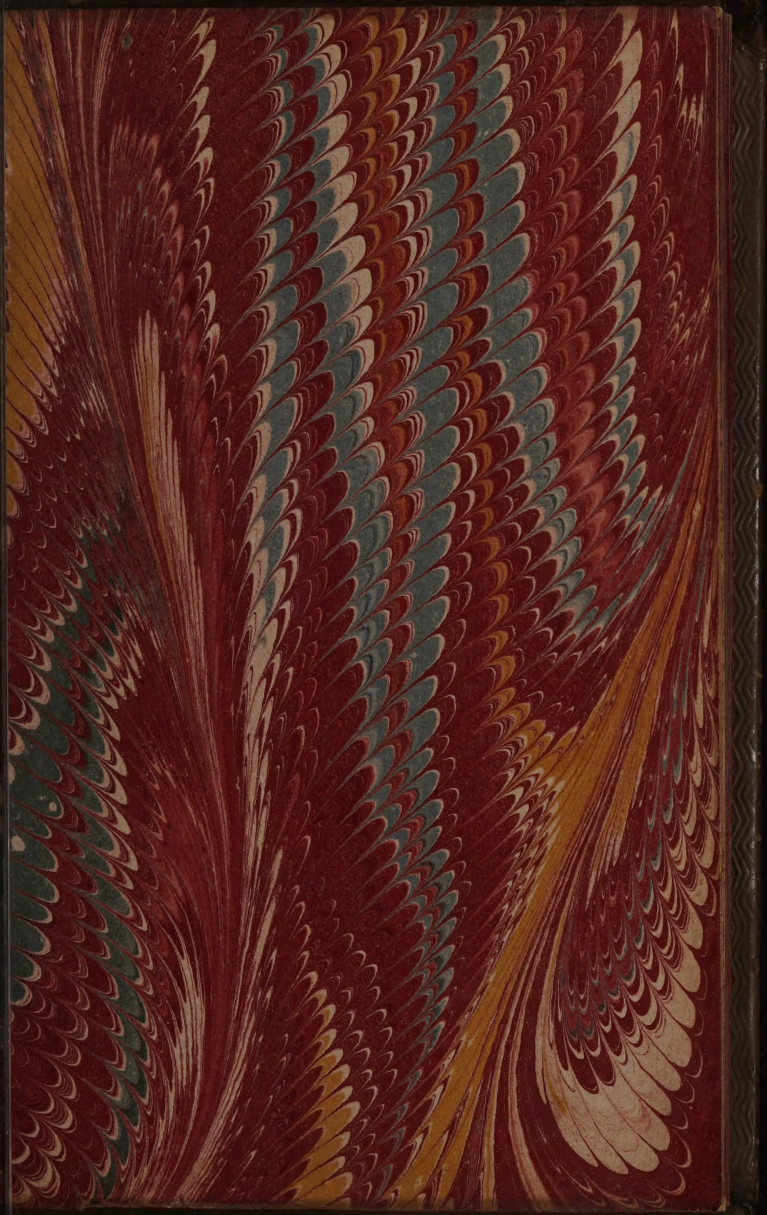
ROBERT BOYLE'S
ICY NOCTILUCA
AND
CHYMICAL PARADOX.





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In

NEW EXPERIMENTS, AND OBSERVATIONS, Made upon the ICY NOCTILUCA.

Imparted in a Letter to a Friend living in the Country.

To which is annexed

A Chymical Paradox.

By the Honourable

ROBERT BOYLE,

Fellow of the *Royal Society*.

LONDON,

Printed by *R. E.* for *B. Tooke*, at the *Ship* in St. *Paul's* Church-yard.

1682.

AN ADVERTISEMENT OF THE PUBLISHER TO THE READER.

THoſe, who have publiſhed ſome former Tracts of this Honourable Author's, have made their Complaints, That his Writings have not met with the ſame Candor and Ingenuity from all Writers: For

though *ſome* have very civilly mentioned his Name in thoſe Experiments, Obſervations, and *Phænomena*, which they have borrowed from His Writings; yet *others* have vendicated that to themſelves, which was none of their own; for having lighted their Candle at his Torch, and raiſed ſome Superſtructures upon thoſe Foundations he had laid, they have made no mention of him at all; in which matter the Sincerity of Philoſophers is not a little required.

'Tis known, That Mr. *Boyle* was the Firſt Inventer of that *Pneumatick* Engine, or *Air-Pump*, called from Him, *Machina Boiliana*; the Figure and many of the uſes whereof he hath deſcribed in his

his *Tract* entituled, *New Phyſico-Mechanical Experiments concerning the Spring and Weight of the Air*, (and in the *Continuation* of it;) which Book, being Tranſlated into *Latin*, and diſperſed into Forreign Parts, hath given occaſion to Tranſmarine *Virtuoſi* to make Eſſays (not altogether unſucceſsful) concerning the Fabricating of the like Engines; though none of their Tracts upon that Subject have equall'd the Original. In like manner 'tis highly probable that his Diſſertations concerning *Phoſphorus*'s, and his free Diſtribution of ſeveral Parcels of that *Luminous Subſtance*; have excited others to deſcant upon the ſame *Subject*.

But that it may juſtly ap-

pear, That the Honourable Author shines only by his own Light, and hath not any thing mutuatitious in the following *Treatise*, the Reader is to be advertised, That this Tract had much earlier come abroad, if, after I had received the *Whole*, even to the last Sheet in 1681. that so the *English* Edition, and my *Latin* Version thereof (wherewith the Noble *Author* was willing to gratifie the *Curious* in Forreign Parts) might be carried on together, I had not been by long Sickness, and divers unfavourable and unexpected Circumstances, obliged to retain it some Months in my Hands.

Which I am the more troubled at, because I find, that my necessi-

neceſſitated Delay hath given Opportunity to the Publication of ſome Experiments about *Noctiluca's*. But the *Virtuoſi*, who have the Honour to be acquainted with the Noble Author of this Book, and have ſeen the laſt *Summer* and *Autumn* divers of the Chief Experiments made, which are mentioned therein, will eaſily believe, that the Author needed not to borrow any thing from thoſe *Specimens* which have been lately publiſhed by an ingenious Man about *Noctiluca's*; which, beſide that they contain but very few *Phænomena*, or *Trials* coincident with *His*, were ſo far from affording him any Information, that (to be ſure,

ſure to be no Borrower) he never would to this day read any one of them, or hear them read. And it appears, by the Cloſe of the *Aerial Noctiluca*, preſented in Print to the *Royal Society*, towards the end of the Year 1680. that he then knew and had practiced ſeveral other Ways of making *Noctiluca*'s, than *That*, which he *Then*, and before any other Man, imparted to the World.

The Uſefulneſs of the enſuing Diſcoveries and Reflexions will be beſt judg'd of by diſcerning Readers, who therefore need not to be previouſly informed thereof by me.

PRE-

THE

PREFACE.

SIR,

THe very kind Reception, you were pleased to give those Papers about the AERIAL NOCTILUCA, *that I address'd to you about the beginning of the last Winter, does not only invite me, but in a manner oblige me to impart to you some Trials, that I made, after I had sent you the others, about the same kind of* Phosphorus; *to which you may now be pleas'd to annex them, by way of Continuation, or Appendix. But that being true, which is noted*

by

by Lucretius, *where he prettily ſays, That*------Res accendunt lumina rebus, *you will not think it ſtrange, that if this Obſervation holds in other things, it ſhould particularly take place in Luminous things themſelves: and therefore, without any further Preamble, I ſhall tell you, That whilſt my Occaſions permitted me to ſtay in* London, *I was willing to try, whether I could carry on ſomewhat further that which had already been not unſucceſsfully begun. And accordingly I caus'd to be prepar'd and diſtill'd four or five ſeveral Materials, which I thought the Curious, eſpecially thoſe addicted to Chymiſtry, would wiſh to have had Trials made upon, and would perhaps blame me,*

me, if I had omitted to employ. But those Materials, not answering what was desired, we made choice of another or two, which I forbear to name, for certain Reasons, and particularly for this, because they are to be found but in very few Places, and perhaps would not have serv'd my turn, if I had not luckily procur'd them in a Season whose Dryness continued almost to a Wonder.

From these Materials sometimes, and sometimes also from the dry'd Residence of Urine, we obtain'd now and then some of the Aerial Noctiluca, *such as That you have hitherto receiv'd Accounts of; but more frequently a Nobler sort of* Phosphorus, *about which I now proceed to impart to*

you

you ſome Obſervations, as I did, without any curious Method or Ornament, ſet them down from time to time as I hapned to make or remember them. And, to facilitate the Pardon I *beg of you, for having omitted ſome Experiments that perhaps you will wiſh* I *had made,* I *muſt acquaint you, That being by ſome Neceſſary Occaſions enforced to leave* London, *for a much longer time than* I *have done for ſeveral Years laſt paſt,* I *have been oblig'd to make moſt of the following Trials in a ſmall Village, where* I *yet am, and where, being unaccommodated with Furnaces,* Inſtruments, *and other Chymical and Mechanical Conveniences, for making and varying Experiments, you receive an Account*

count not of all the Trials, I *would have made, (ſome of the Chief of my Catalogue remaining ſtill unattempted) but of all Thoſe* I *could make in my preſent Circumſtances. However, ſuch as they are,* I *think not fit to delay any longer the acquainting you with them ; and therefore have order'd them to be gather'd into one ſmall Collection of* Memoirs, *to which Paper* I *have given the Title of* The Glacial or Icy Noctiluca, *not only to diſtinguiſh it from the* Aerial *one, whereof you have already had an Account ; but for another Reaſon, that you will quickly meet with in the little Tract it ſelf, from whoſe Peruſal* I *muſt not now any longer detain you.*

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APPENDIX

To the

AERIAL NOCTILUCA.

SECT. I.

THE ſhining Matter, contain'd in our beſt Phials, being partly waſted in Experiments, and partly given away, I thought fit to try, whether by the help of Heat and other Motion, our want might not be ſomewhat ſupplied, till more *Noctilucous* Matter could be prepared.

Experiment I.

In purſuit of this Deſign, I took an old Phial that had been long laid aſide as uſeleſs, becauſe the Matter had been poured out of it into a clearer and ſmaller Glaſs, and having held that ſide of this Phial, to which I perceived ſome Feculent Matter ſtuck, near the Fire, till it had conceived a conſiderable degree of warmth, I remov'd it into a dark place, and as I expected, found it to ſhine, and that Vividly enough, whilſt it retain'd a Competent degree of heat; and when it cooled too much, the Light ceaſed with the Agitation, that as a Cauſe or a Condition accompanied it. But if afterwards the Phial were again held to the Fire as before, the ſhining Power would be excited, and the Splendor would continue a pretty while. But after ſome days or weeks (for I remember not which,) this Diſpoſition to be made Luminous by external heat, was utterly loſt. *Experi-*

Experiment II.

Having alſo taken notice of a little Feculent Stuff, that ſtuck to the inſide of the Glaſs, that had contain'd ſome of our *Noctilucal* Matter, I imagined, that though it would not ſhine in the dark by the contact of the Air, to which it had been too long accuſtomed; yet when once that diſpirited or diſanimated Superficies, (if I may ſo call it,) that had lain expoſed to the Air, was removed, the more Internal part of the Matter might not be deſtitute of a ſhining Power. I carefully ſcraped off, the outermoſt Surface, and rubbing a little of the reſt with my finger upon my hand, I found it to ſhine well enough. And though the Matter, being once more left expoſed to the Air, did loſe in its Superficial parts the Virtue of ſhining in the dark; yet thoſe parts being taken off, the remaining Matter (being rubb'd) did not appear deſtitute of a Luminous

Quality, ſo that it ſeemed, that though the Air did after a while, mortifie as it were and ſpoil the Superficial parts that were expoſed to its immediate Contact, yet this vitiated Surface ſerved for a kind of Cover or Fence to the Matter that lay beneath it, and kept it from Evaporating or Spending thoſe Spirituous or Subtile parts, on whoſe Account it was capable of becoming Luminous.

Experiment III.

And as I had obſerved on other occaſions, that Liquors abounding in Tenacious parts, though the Liquors did not appear opacous or Feculent, would leave ſticking to the inſides of the Glaſſes, that contained them, ſomewhat, that though generally not perceived, becauſe not very manifeſt, was by ſome other ways that I had tried diſcoverable: Having, as I was ſaying, obſerv'd this, in ſome other Caſes, I ſuſpected, that even in a Phial that had formerly contained

contained ſome of our ſhining Subſtance, though it ſeemed to have been well emptied, and to have no groſs Feculency adhering to it, there might ſtick ſomewhat, which though unobſerved by the naked Eye, might be made viſible to the naked Eye, by heat or motion. In purſuance of this Conjecture, I took this Glaſs, and having crackt it into Fragments, that it might be put into the neck of a Phial of a convenient ſhape and ſize; and having well ſtopt the Veſſel and removed it into a dark place, we there ſhook it, and had the pleaſure to ſee, not only that Light was readily produced by the motion excited in the juſtling of the parts one againſt another, but that by reaſon of the various poſition of the Fragments of Glaſs, ſome looking upwards, ſome downwards, ſome to the right hand, and ſome to the left, the light ſeemed to be Vibrated every way, with a very delightful Vividneſs. This Production of a kind of blazing Light was often repeated with theſe bro-

ken pieces of Glaſs, and if the Phial were heated, the effect ſeemed more quick and conſiderable: And (if I miſremember not,) by only warming the Phial, without ſhaking it, a Light would be produced.

Experiment IV.

Afterwards having beaten ſome of the Glaſs into ſuch ſmall pieces as were capable of paſſing through the neck of a Glaſs-Egg with a flat bottom, that it might ſtand upright of it ſelf, we Hermetically ſealed up the neck, to try whether by this hindring the included Matter from exhaling or tranſpiring, we could keep the beaten Glaſs always fit to exhibit the *Phænomenon*; but we found not the event anſwer our deſires, for after no long time, we could no more produce any Light in our Sealed Veſſel, though an unlucky Accident happening in one of our laſt Tryals, keeps me from being fully ſatisfied of the unpracticableneſs of the thing deſigned. *Experi-*

Experiment V.

In the Printed Tract of the *Aerial Noctiluca*, there is mention made of ſome Liquor that was *Hermetically* Sealed up in a bolt-Glaſs, that was not great, to try whether by this way we could for any long time preſerve the ſhining faculty of that Liquor wherein it was already exceeding faint, and not to be excited but by a conſiderable degree of heat, and a vehement agitation of the Veſſel it ſelf. This Sealed Glaſs having been left in the corner of a Window, for what was judg'd a competent time, we yeſternight approached the Veſſel by degrees to the Fire, and ſhaking it from time to time till the included Liquor had acquired a conſiderable degree of heat. Then removing it to a dark place, and ſhaking the Veſſel ſomewhat ſtrongly, we perceived that the diſpoſition the Liquor had to ſhine, was very much impaired, but not quite

abolifhed. For there would from time to time, upon the rude agitation it was put into, appear little portions of Matter that looked prettily, and fhone very Vividly, like fparks of Fire; and fome of thefe appeared in the *Spherical* part of the Glafs, and fome in the Neck. Some of them feemed as it were fixed to their firft Station, and others moved upwards and downwards, and moft of them continued fome time to fhine a pretty while before they difappeared, and when they vanifhed, few of them did fo by degrees, but each luminous fpeck, when it had lafted out its time, loft its whole Light at once.

SECT. II.

THE new Liquid *Phofphorus*, I lately mentioned to have been made, fince the publifhing of the *Aerial Noctiluca*, was poured into a large Phial, that might contain (by our guefs) ten or twelve times as much

much as was put into it, ſo that the ſhining Matter, having ſo much Air included with it, might thereby be aſſiſted to diverſifie at leaſt ſome of the *Phenomena* afforded by former *Noctilucas*.

Obſervation I.

And accordingly I obſerved in the firſt place, that though the ſhining ſteams filled the whole cavity of the large Glaſs, that was untaken up by the Liquor and the reſidence, and this lighter flame continued much longer at once, than any we have hitherto mentioned, for it continued Vivid ſeveral Days and Nights together, without ever unſtopping the Phial to give it freſh Air. And, if I miſremember not, I obſerv'd it to do ſo for about a week, before my occaſions hindred me from obſerving it any longer.

Obſervation

Obſervation II.

I ſometimes took notice with pleaſure, that ſome Exhalations or Vapours, that appeared conſiderably luminous, ſeemed to roll to and fro, like little Clouds or Aggregates of Smoak in the Cavity of the Veſſel, though it ſeemed difficult to determine what ſhould give them, and maintain in them, ſuch a motion.

Obſervation III.

The bigneſs of the Glaſs being conſiderable, it happened that ſometimes when I went into the darkned place where I kept it, ſo much luminous Matter would make a ſurpriſing ſhow, but though its extent were far greater, yet its intenſity did not much exceed that of the Light afforded by the *Noctilucas* of the firſt ſort, as for diſtinctions ſake, thoſe may be called that are mentioned in the Printed Account. Only this I often took

took notice of, that, in caſe I ſhook the Matter gently, the Light would appear much more vivid, and, as it were, would flaſh in and about the ſurface of the Liquor where it was Contiguous to the Air, than it did elſewhere. And this ſplendor was ſuch, that if it had been laſting, I thought it would have made our *Phoſphorus* uſeful for conſiderable purpoſes.

Obſervation IV.

When after having ſo many Days kept this Glaſs ſtopt, at laſt it would not longer ſhine of it ſelf, we ſuppoſed it to be reduced to the condition of a *Phoſphorus* of the firſt ſort, and accordingly found, that upon the removal of the Stoppel, and ingreſs of freſh Air, the Cavity would in a moment be filled with fumes that lookt white in an enlightned place, but luminous in a dark one, and (probably by reaſon of the quantity of the Air contain'd in ſo capacious

cious a Glaſs) the light uſually continued much longer than 'twas wont to do in *Noctilucas* of the firſt ſort.

Obſervation V.

Being deſirous to try, whether this more vigorous Matter, if it were kept ſo exactly ſtopped, that none of the Luminous Vapours could exhale, would not laſt very long, I put near two ſpoonfuls of the Liquor with ſome of the ſediment into a bolt-Glaſs (with a flat bottom that it might ſtand without leaning) capable of containing in all near twice as much, this Glaſs being Hermetically Sealed, the included Liquor continu'd to ſhine without any external help either of Air or Heat, for about ſix Days and Nights, but then it gave over ſhining, nor would be made luminous again by moderate ſhaking.

Obſervation VI.

After having poured out ſome more of the Liquor and Sediment that had been kept in the great Phial, formerly mentioned, into a ſmaller Phial, to make a Preſent of it to a *Virtuoſo*, the remaining Matter, having now a greater proportion of Air included with it, was very apt to be put into a Luminous agitation, if I may ſo call it, and would emit Exhalations, that would not only fill the Cavity of the Glaſs, but manifeſtly move to and fro in it after a ſomewhat odd manner. And being one Night willing to give a Lady, and ſome other Company, the divertiſement of a new *Phenomenon*, after having opened the Phial, and then having ſtopt it again, I ſhook it, and turned it in ſuch a way, that much the greateſt part of Liquor having been before poured out, the reſidence was as it were ſpread over the inſide of the Glaſs, to which its Particles

ticles ſtuck, becauſe there wanted Liquor enough to waſh them down: By which means, thoſe little portions of the Sediment being not covered, as they were wont to be with Water, but expoſed to the immediate Contact of the Air, ſhone much more vividly than the Luminous Exhalations were wont to do, and the light being tremulous and twinkling, as well as brisk, they ſeemed to emulate ſo many little Stars in a Cloudleſs but dark Night, and continued this Scintillation longer than one would have expected, to the no ſmall delight of the beholders, for whoſe ſake the Experiment was ſeveral times repeated with ſucceſs.

NEW

NEW PHÆNOMENA

Exhibited by an

ICY NOCTILUCA,

OR,

Solid Self-ſhining Subſtance.

SECT. III.

IN the Addreſs of the foregoing Appendix to the *Aerial Noctiluca*, I intimated the Reaſon, why I did not think fit to give you a more particular account of the Materials I employ'd in proſecuting my deſign, of making better qualified *Noctilucas*. And therefore I ſhall not for the preſent trouble you with the mention

mention of proceedings, that for want of ſome things ſeldom procurable, you would not where you live, be able to imitate: But ſhall ſave you and my ſelf the trouble of a further preamble.

Having then by proceſſes, not unlike that I annexed to the Cloſe of the *Aerial Noctiluca*, obtain'd a Self-ſhining Subſtance of a *Conſiſtent form*; I proceed to give you ſome account of what I have obſerved about it, and try'd with it, which will take up the leſs time to do, becauſe many things belonging to it in common with the ſhining Liquor, with which I have already entertain'd you, thoſe will be the fewer that belong peculiarly to the Self-ſhining Matter, endow'd with a *Conſiſtent form*.

About which it may be proper to take notice of ſome affections, that ſeem more immediately to belong to the Subſtance it ſelf, than moſt of the things do that are to follow.

Some

Some Qualities of the Noctiluca *it ſelf.*

1. And firſt, Though it uſually came over in diſtillation in the form of divers little Grains, or Fragments, differing for the moſt part from one another, both in bigneſs (ſome being of the ſize of Grains of Corn, and others of Peaſe, or large Cherry-Stones) and alſo as to their ſhapes, which moſt commonly were irregular, as Concretions are wont to be, that are caſually produced, yet when the Diſtillation was carried on proſperouſly, we obtain'd the deſired Matter in greater Lumps, ſometimes as large as ſmall Beans, and ſometimes at leaſt three or four times as large, but not proportionably thick.

2. Theſe Lumps whether ſmall or great, were Colourleſs; and uſually when they were held againſt the Light, tranſparent; ſo that divers Bodies placed beyond them at a convenient diſtance, might be plainly

ſeen through them. And ſome of the bigger appeared ſo like ſuch Fragments of *Ice*, as being thin, are oftentimes very clear, and almoſt quite deſtitute of manifeſt Bubbles; that becauſe of this great reſemblance, and for diſtinction ſake, I thought it not amiſs to call our conſiſtent Self-ſhining Subſtance, the *Icy* or *Glacial Noctiluca* (and for variety *Phoſphorus*) which name I choſe to give it, rather than that of *Cryſtalline*, becauſe this Epithet is not unfrequently given to every *Diaphanous* Liquor, as well as to *Tranſparent* Solids. But when I ſaid, that our *Noctiluca* was Tranſparent and Colourleſs, I meant it only in reference to what uſually appeared. For whether it were any real difference in the Texture or conſtitution of the Body it ſelf, or the effect of ſome caſual junctures of Circumſtances, I am not ſure; but this occur'd to us, that ſometime, eſpecially by Candle-Light, ſome leſſer Fragments appeared not *Diaphanous*, nor always either Colourleſs, nor of the ſame

ſame Colour. For ſometimes the Matter looked Reddiſh, ſometimes of a faint, but pleaſing Blew, and ſometimes too, of a Colour to which I cannot eaſily aſſign a known Name.

3. Our *Icy Noctiluca* or *Phoſphorus*, is manifeſtly heavier in *Specic* than common Water, in which being put, it readily ſinks to the bottom, and quietly lies there.

4 The Ice-like Body, though conſiſtent, is not hard; being far leſs ſo, than common *Ice*; but yet 'tis not ſo ſoft but that 'tis brittle, and will more eaſily be broken in pieces by the preſſure of ones Fingers, than receive ſhapes from them; and yet by him that goes ſomewhat warily to work, it may be ſpread upon a ſolid Body, almoſt like the unmelted Tallow of a Candle.

5. The Conſiſtent *Phoſphorus* is fuſible enough. For though in the Air it will not be brought to melt, without ſome difficulty and waſte, yet by the help of hot Liquors, and even of Water it ſelf, it may with a

little care and dexterity be brought to melt, which is an Obſervation of good uſe; becauſe by means of fuſion, ſeveral Fragments (if the Matter be pure enough) may be brought to run into one Lump, and in that condition may both be the better preſerved, and become fit to be applied to ſome conſiderable uſes, which cannot ſo well, if at all, be made of leſſer, though numerous Fragments.

6. This *Glacial Noctiluca* is, as to ſenſe, cold, but of a texture that diſpoſes it to be eaſily agitated, and by agitation become incaleſcent, as will appear hereafter. When this Solid *Noctiluca* is held in the free Air, though perhaps its ſuperficies be wet, it affords a very vivid Light, uſually ſurpaſſing That of the *Aerial Noctiluca*, and this Light ſeems to proceed from, if not alſo to reſide in the Body it ſelf.

7. When our *Icy Phoſphorus* is taken out of its receptacle, and expoſed to the immediate contact of the free Air, it uſually emits a wonderful deal

deal of Smoak, discernable by the Light of the Body it ascends from; and this plentiful emission of Effluviums usually lasts as long as the *Phosphorus* is kept in the Air.

8. But 'tis pleasant to observe, and deserves to be considered, That as soon as 'tis plung'd in Water, so as to be quite covered with that Liquor, it ceases not only to Smoak as before, but to shine, as if a thorowly kindled Coal were suddenly quenched in Water. And if it were not for this, our *Noctiluca* would effluviate so fast, that it would be quickly wasted; whereas the Water, fencing it from the contact of the Air, keeps it from spending it self as formerly, and yet does really make but a seeming and temporary extinction of this *Anomalous* Fire. For as soon as 'tis again taken out of the Water (though it have lain there perhaps a great while) it falls to shine again, even whilst 'tis yet dropping wet.

9. And I have sometimes had the pleasure to observe, that when I had

ſo large a Piece of *Noctiluca*, that I could conveniently hold one half of it under the Surface of the Water, and the other half above it, whilſt the emers'd part afforded no Light, the extant part ſhone Vividly.

Having thus mentioned moſt of the qualities that belong to the Noctiluca it ſelf, I ſhall now proceed to the *Phenomena*, my Tryals on it, or with it afforded me, without confining my ſelf to any ſolicitous order, ſince my Circumſtances permitted me not to keep one in making thoſe tryals. But before I deſcend to other Particulars, It will not, I think, be amiſs to take notice of a few, that, having more affinity than others with the laſt mentioned quality of our *Phoſphorus*, ſeem proper to be annexed to what has been delivered of it.

OBSERVATIONS

About The

WATER

Wherein the

NOCTILUCA

Was kept.

SECT. IV.

BEcauſe I gueſſed that the Water wherein the *Noctiluca* had been long kept covered, to fence it from the Air, though it did not manifeſtly diſſolve the Maſs, yet might be impregnated at leaſt

with the more *Saline*, and on that account resoluble parts of it, I thought fit to make a few tryals upon this Liquor.

Experiment I.

And First, I found that it had a strong and penetrant taste, that seemed near of kin to that of Sea-Salt, but was more piercing, as if Brine were mingled with Spirit of Salt, and it relished also somewhat of Vitriol.

Experiment II.

Being put into a small concave Vessel of Refin'd Silver upon lighted Coals and Ashes, it evaporated but very slowly, and would not be brought to shoot into Crystals, nor yet to afford a dry Salt, but coagulated into a Substance sometimes like a Gelly, and sometimes, as to consistence, like whites of Eggs; which Substance was easily melted by heat.

Experiment

Experment III.

When this Subſtance was kept a while on a hotter Fire, it only boiled at firſt, but ſoon after began, as I gueſſed it would, to make a crackling noiſe; wherein, this was remarkable and pretty, that the Exploſions were accompanied with flaſhes of Fire and light, which if they were ſmall, were generally very Blew, like the Flames of Sulphur, but more Vivid, and ſometimes alſo more Blew; but the greater cracks, whoſe noiſe was conſiderable, were wont to appear of a Yellow colour and very Luminous. And theſe *Phænomena* did not only appear whilſt the Matter was Boiling over the Fire, but a pretty while after the Veſſel was taken off and held in the Air.

Experiment IV.

If before the Coagulated Matter were too far waſted by the heat, it were

were ſuffered to coole a little, it appeared to have acquired a conſiſtence like melted Roſin; or rather ſtiff Bird-Lime, for it would draw out into Threeds of, perhaps, a Foot or more in length; and having held one of theſe Threeds to the Flame of a Candle, it did not take Fire, but melted into little Globul's, as capillary Threeds of Glaſs are in like circumſtances wont to do. And having made ſome of them ſtick to the wieck of a Candle, towards the bottom of the Flame, they Coloured the lower part of the flame quite round with a very fine Blew, which laſted much longer than one would have Expected.

Experiment V.

This glutinous Subſtance had, by the Action of the Fire, acquired an odd kind of ſtrong ſmell, almoſt like That of Garlick, and being left all night in the Air, attracted to it (to uſe the Vulgar Phraſe) the moiſture

ſture of it, exceeding faſt, being diſſolved in a good part into a Liquor almoſt as ſtrong as Spirit of Salt.

Experiment VI.

Putting this Subſtance again over the Fire, as before, it appeared to be more fixt than one would have looked for, for though there were not ſo much as a Spoonful of it, yet it continued Boyling for a great while, and afforded a Multitude of ſhining *Exploſions*, whereof ſome made a conſiderable noiſe, and gave notable flaſhes of Light, which ſeemed to be made by condens'd and agitated Fumes, ſuppreſſed by the ſomewhat hardned Surface of the Matter, and kindled in their eruption into the Air, into which ſome parts of theſe Fumes, that were not kindled, eſcaped in the form of a Smoke, whoſe ſmell was very ſtrong and rank, but of a peculiar kind. To which I ſhall add, what ſeemed ſtrange, that though oftentimes two, and ſometimes more flaſhes

appeared

appeard at once, yet ſo ſmall a quantity of Matter continued to afford them for almoſt an hour together, and probably would have done it longer, but that the late time of the Night obliged me to go to Bed, before the Experiment was finiſhed.

What

What Liquors would, or would not diſſolve, the Icy Noctiluca.

SECT. V.

AMong other ways of inveſtigating the Nature of our *Icy Phoſphorus*, I thought fit to try, whether or no it would be diſſolved in ſome Liquors of differing kinds, hoping, that if it would be ſo in any of them, it might ſomewhat aſſiſt us to gueſs at its Texture.

Experiment I.

We found then by tryal, That common Water would not in the Cold diſſolve it, though the Liquor was thereby Impregnated, as when *Crocus Metallorum*, or Glaſs of *Antimony*, being infuſed in Wine or Water, the

the Menſtruum will be Impregnated by its Emetick Particles, and yet the Bulk, Shape, and Colour of the Crocus, or the Glaſs, will not thereby be viſibly diminiſhed or altered.

Experiment II.

Afterwards we put a Grain or two of our Lucid Matter into a little Urinous Spirit of *Sal Armoniac*, but it ſeemed not to make any conflict with it, nor manifeſtly to work upon it, though, to give the Liquor time to make a Solution, we left them together for ſeveral days. But as ſoon as we had poured aſide the Spirit, it appeared that it had not by any contrariety deſtroy'd the power of the *Noctiluca*, which began readily to ſhine as formerly, and yet, might be immediately ſuppreſſed again, by ſuffering the Liquor to cover it as before; but when we had, by keeping the Phial for ſome time in a moderate heat, Impregnated the Liquor with it, this Liquor, being then dropt into

into Water, had a like effect with That mentioned in the Experiment of Impregnated Spirit of Wine.

Experiment III.

Seeing a Volatile and Urinous Salt would not work ſenſibly upon our *Phoſphorus*, we thought fit to try, what Corroſive Liquors would do, and accordingly, we put a Grain or two of our Splendent Matter into a very ſmall Phial, wherein was a little Oyl of *Vitriol*, that Menſtruum appearing, in many caſes, more Corroſive, than other vulgar *Acids*, but neither did this Menſtruum diſſolve our *Icy Noctiluca* in the Cold, and therefore putting it in ſome heat, we found, that though it did not manifeſtly diſſolve the ſhining Matter, yet the warmed Oyl made it melt, and appear at leaſt for the time a fluid Body; in which this ſeemed to me remarkable, that this ſo fugitive a Subſtance ſhould be ponderous enough to lye at the bottom of Oyl of

of *Vitriol*, which is one of the heavieſt Fluids we yet know, except Quickſilver, which many will not allow to be a Liquor. What we did with this melted *Noctiluca* was not unpleaſant to ſee, and will, God permitting, be hereafter mentioned.

Experiment IV.

Afterwards we put a ſmall Fragment of our *Icy Phoſphorus* into *Aqua-Fortis*, and though we kept it in that Menſtruum, two or three Days, and ſet the Vial that contained them for many hours in a warm place, (the Chimney Corner) yet we found the Matter ſo little altered, as to its viſible appearance, that we doubted whether the Liquor had diſſolved any ſenſible quantity of it.

Having tryed Saline Menſtruums upon our *Icy Phoſphorus*, I thought fit to try Oyls, and alſo Spirit of Wine, that is reckoned by Chymiſts to be of great affinity with them.

Experiment

Experiment V.

Whereupon I put a little of our *Noctiluca* into ſome Oyle of *Turpentine*, which not diſſolving it in the Cold, the ſmall Vial that contained it, was left all Night in the Chimny upon warm Aſhes. But though the next Day none of the *Phoſphorus* appeared any longer in the Glaſs, yet we could not perceive by two or three differing Tryals, that the Oyle was much altered by it, and particularly I obſerved that though the Glaſs were unſtopt, and kept ſo for a while, yet the Ingreſs of the Air did not produce any ſenſible light, nor did we perceive the upper part of the Glaſs to be full of white Fumes, as is uſual in divers other Liquors Impregnated with our *Noctiluca*, when they are unſtopt.

SECT. VI.

IT has rendred the Experiments made with the *Aerial Noctiluca*, much leſs acceptable, than otherwiſe they would have been, to the delicate ſort of Speculators, eſpecially to Ladies, that the Light they produced was accompanied with a very unpleaſant ſmell, that iſſued out of the Phial whenever it was unſtopped, to let in the Air. But by the help of our *Icy Noctiluca*, I found a way to prevent this ungrateful concomitant of our Artificial Light. But not being diſcouraged by the bad ſucceſs of the forementioned Experiment, I hoped an *Aromatical* Oyl might do, what *Subtil* Oyles had not done.

Experiment I.

And therefore having in a very ſmall Phial put about a Grain of *Noctilucal* Matter, and cover'd it with as much pure Eſſential of *Cinamon*, as would

would ſwim leſs than a Fingers breadth above it, we carefully ſtopt our little Phial, and having warily held the bottom of it againſt a Fire, till the *Phoſphorus* began to melt, I ſuffered it to Cool; and then unſtopping it in a dark place, had the pleaſure to ſee produced a Vaniſhing indeed, but a Vivid Light. So that by this means I could afterwards ſhew the production of Light to the neareſt Perſons of Quality, not only without offending their Noſes, whilſt their Eyes were gratified, but with adding to the pleaſure of a delightful Apparition, That of a Fragrant ſmell. But becauſe Oyle of *Cloves* is more eaſie to be had good, than the Oyl of *Cinamon*, and is alſo much cheaper, I tryed the Experiment more fully with That, and therefore ſhall proceed to give you (for an Example of *Aromatick* Oyles) the *Phænomena* of it:

Experiment II.

We put ſome of our Luminous *Ice* into a little pure Oyl of *Cloves*, ſuch as the *Chymiſts* call Eſſential, but found after a conſiderable time (no leſs than ſome Days) that at leaſt a good part of the Matter was undiſſolved, but yet the Liquor was richly Impregnated by it, as we found by a pretty *Phænomenon* that it afforded us. For the little Phial, it was kept in, being opened in a dark place, there immediately enſued a kind of flaſh of Light, far more Vivid, its ſmall Bulk conſidered, than any Liquor had afforded us before. But the brightneſs of this Apparition was it ſeems too great to be laſting, for this Flame-like Subſtance uſually expired in leſs than a Minute of an Hour, ſometimes perhaps in half that time. And there were two other Circumſtances particular enough in this *Phænomenon*; *One*, that ſometimes, eſpecially if a Candle were in the Room, the ſhining

ning *Fluid* would appear of a pleaſant and ſomewhat ſurprizing Blewiſh Colour. And the *Other*, that the Light would ceaſe whilſt yet there remained in the upper part of the Glaſs pretty Store of Whitiſh Fumes, ſuch as we have formerly often Obſerved in the *Aerial Noctiluca* to be the uſual Cauſes or Concomitants of Light, as if in our preſent caſe the ſhining Subſtance prey'd on, or reſided in only the finer and more delicate Particles of the Whitiſh Exhalations.

Experiment III.

Inſtead of the Oyl of *Cloves*, we ſubſtitued ſome *Chymical* Oyl of *Mace*, into which we put a competent quantity of the Glacial *Phoſphorus*; but though we warmed the bottom of the Phial, at leaſt as much as we judged neceſſary, yet, upon the unſtopping of it, there appeared no ſign of Light, though the tryal was made much more than once or twice,

and ſometimes with favourable Circumſtances, which event was the leſs expected, becauſe the Oyl, made uſe of, was preſented me as very pure, by the ſame Traveller who gave me That of *Cloves* newly mentioned. And becauſe alſo the Warmed *Phoſphorus* was ſo well conditioned, that as ſoon as ever the Oyl was removed, it ſhone with a ſomewhat extraordinary Vividneſs.

Experiment IV.

We made alſo a Tryal or two with Diſtill'd and Fragrant Oyl of *Anniſeeds*, to ſee, if That being an Eſſential Oyl as *Chymiſts* ſpeak, and being look'd upon by many as a kind of *Aromatick* Oyl, it would better diſſolve the *Noctiluca*, or be Impregnated by its *Luciferous* parts; but we found that it neither diſſolved the Matter, nor upon the unſtopping of the Phial, that contain'd it, did it afford any Light, or ſo much as Whitiſh Fumes, which ſeemed ſomewhat ſtrange, becauſe

cauſe the Oyl was very ſubtile, and by its aptneſs to *Coagulate* of it ſelf, ſhewed that it was Genuine, and not as Chymical Oyles that are Venal too frequently (if not moſt commonly) are, *Sophiſticated.*

If theſe two laſt recited Experiments prove conſtant, they will argue that not every *Fragrant*, no, nor every *Aromatical* Oyl, properly ſo called, has the like operation upon our Noctilucal Matter, as the Oyl of *Cloves* and *Cinamon* have.

If I had had or could have procured other Eſſential Oyls, on whoſe Genuineneſs I could have depended, I had try'd their effects upon our *Phoſphorus.*

Experiment V.

But having no more Oyls fit for my turn, I next tryed whether I could diſſolve our ſhining Matter in Ardent Spirits, which are thought by *Chymiſts* to be of near Conſanguinity with diſtill'd Oyls; (not

now to enquire, whether they do not consist of the finer parts of the highly rarified Oyl of Bodies, united with a great proportion of their *Phlegm*) and having accordingly put some of our *Icy Phosphorus* into the Spirit of wine, though the Menstruum did some hundreds of times exceed the Body 'twas to work upon, yet after divers days, wherein it stood in a Window, exposed to the Sun Beams, in the hottest part of the Summer, it appeared undissolv'd at the bottom of the Liquor, and scarce sensibly diminished. But of the separation of Spirit of Wine upon the *Noctilucal* Matter, further tryals will require, that more be said hereafter.

Of

Of a way of ſuddenly producing Light in common Water, by the help of another, not Luminous, Liquor.

SECT. VII.

I Come now to recite to you a *Phænomenon* which I preſume may not diſpleaſe you. I had a hint of it from a caſual Obſervation made by my induſtrious Laborant. For having, to incourage him, allow'd him for his own uſe ſome Fragments of our *Icy Noctiluca*, he mingled a portion of this ſhining Subſtance with a Spirituous Medicinal Liquor that he had prepared, by extracting ſeveral Drugs with it, and having afterwards upon ſome occaſion or other diluted it with Water,

ter, it afforded him a *Phænemenon*, at which being ſurpriz'd, he came to acquaint me with it, bringing me withal ſome of the Liquor. But I thinking that the *Phænomenon* did not depend upon the Peculiar Nature of the Liquor, whoſe being very Compounded and high Coloured made me judge it not fit for *Luciferous* Experiments, but proceeded from the Vinous Spirits wherein that Liquor abounded, I thought fit to make the Experiment with a Liquor as Colourleſs and Simple as I could. The effects of ſuch Liquors being more eaſie to be diſcerned, and judged of, and reaſoned upon. And accordingly we weigh'd out in a tender Ballance one Grain of our *Glacial Phoſphorus*, wiped dry, and broken in four or five pieces, for the eaſier diſſolution. And to theſe in a *Cryſtalline* Phial, we put a convenient quantity of highly Rectified Vinous Spirit, and ſtopping the Phial cloſe, we ſuffered the things contained in it, to remain for many hours, ſometimes (and indeed

deed for the moſt part) in the Cold, and ſometimes in the Warm Sun, but perceived not that near a total diſſolution was made of the *Noctilucal* Matter by the Liquor in which it lay, even one of the leſſer Fragments appearing, as well as the others, undiſſolved in the bottom of it. However, ſince a Body conſiſting of ſuch ſubtile parts may communicate many of them to a contiguous Liquor without any diminution of its Bulk, obſervable by the Eye, I thought fit to try what Effects this Body had upon the Vinous Spirit.

Obſervation I.

And Firſt, I Obſerved, that it did not manifeſtly diſcolour the Liquor, but leſt it Tranſparent and Limpid, as before, ſave that there appeared ſome very ſmall Earthy Corpuſcles, like Duſt at the bottom of the Liquor, when being a little ſhaken (to raiſe them) it was attentively view'd.

Obſervation

Obſervation II.

We did not Obſerve that, upon the unſtopping of the Phial, and the reſtored commerce between the inward and outward Air, there appeared any flame or Luminous Exhalations, as is uſual upon opening Phials that contain the Liquid *Aerial Noctiluca.*

Obſervation III.

But the *Phænomenon* I chiefly intend to relate was This, That, having in a dark Night dropt a little of this Impregnated Spirit into a ſmall *China* Cup, with common Water in it, though the Spirit neither in the Phial, nor in its paſſage through the Air, diſcloſed any degree of Luminouſneſs, yet as ſoon as ever the drops came to touch the Liquor, they would be as it were kindled by the Cold Water, and afford little flaſhes of Light, which was more

Vivid

Vivid than the *Noctiluca* it ſelf, affording a Splendor that made not only the brims of the Cup, but divers of the Neighbouring Objects manifeſtly Viſible, not to ſay conſpicuous. But theſe *Coruſcations* had the property of other Lightning, to vaniſh almoſt as ſoon as they appeared, nor would the Water, that produced them, by being agitated, ſhine; but others might immediately be produced, by letting freſh drops fall into the ſame Water, upon whoſe Surface they ſeemed to diffuſe themſelves, and would ſometimes leave for a little while a faintly Luminous as it were Film or Membrane.

Obſervation IV.

And that it might not be thought that this accenſion (if I may ſo call it) was produced or occaſioned by any *Antiperiſtaſis*, which the School-Men, and the generality even of *Philoſophers*, are pleaſed to fancy (whoſe Opinion I have in a particular diſcourſe

ſcourſe examined) I thought fit to try, whether our *Phænomenon* would not be produced with *hot* Water as well as with *cold*, and accordingly I found that the Impregnated Spirit of Wine produced rather a greater than a leſſer Light in hot Water than it had done in cold.

One of my deſigns, I had in making this Experiment, being to examine a conjecture I had made about the great diffuſedneſs of the *Noctilucal* Matter, the ſubtilty of whoſe Particles made me think they were not to be judged abſent where ever they were not numerous or agitated enough to be of themſelves Viſible: this I ſay being in my thoughts, I judg'd it not fit to put our Splendent *Icy* Matter into the Spirit of Wine at adventures. Wherefore having in a very good Ballance weighed out one Grain of our *Noctiluca*, (firſt wiped dry,) we put to it at ſeveral times, that it might the better diſſolve, above two thouſand Grains of Spirit of Wine, that would

burn

burn all away; and yet, which may ſeem ſtrange, this ſmall quantity of *Noctilucal* Matter did ſo Impregnate all the Liquor put upon it, that though nothing of Luminous did appear in the Menſtruum nor in any Exhalations riſing from it, though the Phial were unſtopped, or the Liquor poured out of it into the Air, yet as ſoon as ever 'twas dropt into common Water there would be produced a Vivid Apparition of Light, ſuch as has been a little above deſcribed.

It ſeemed not very improbable, that theſe ſuddain and vaniſhing flaſhes might, at leaſt in great part, proceed from the quick diſingagement and extruſion of the *Noctilucal* Particles, made by the Water, which, diluting the Vinous Spirit, diſabled them from retaining with them the Luciferous Corpuſcles. As if into one Ounce of high rectified Spirit of Wine, you put half a Dram, or a Dram of *Camphire*, the Liquor will diſſolve it, without being thereby manifeſtly altered

altered as to Colour or Transparency; but if you drop this solution into common Water, the Vinous Spirits will immediately diffuse themselves into the Liquor, and let go the Corpuscles of the *Camphire*, which will Float like a White Powder upon the Surface of the Water. To this Conjecture is agreeable what upon Tryal we Observed with our Impregnated Spirit of Wine namely, that being dropt into other, well *Deflegmed* Spirit of Wine, we saw no Light produced; but when it was dropt into an Urinous Spirit of *Sal Armoniac*, which seems to consist of the Volatile Salt dissolved in the Phlegm or Aqueous Liquor, the *Noctilucal* Corpuscles by this Waterish part were freed from the Vinous Spirits, almost as much as they would have been by common Water, and did accordingly shine with much briskness.

Experiments

EXPERIMENTS

Discovering a Strange

SUBTILTY

Of parts in the

GLACIAL NOCTILUCA.

SECT. VIII.

BUT what has been above recited, is not all that I thought fit to try with the shining Matter, that I told you we dissolved in Spirt of Wine, for after having, as I lately recited, brought one Grain to Impregnate between four and five Ounces of *Alcohol*, as the *Chymists* call the high Rectified

Spirit of Wine, which did at leaſt two thouſand times exceed the weight of the *Noctilucal* Matter, I preſum'd that this very parcel of Spirit of Wine, wherein the ſhining Matter was already diffuſed and ſcattered into ſo many thouſand *Corpuſcles*, as ſufficed to Impregnate all the Liquor, would yet communicate to a good quantity of Water Particles enough to make it ſhine, when agitated, wherefore when we had weighed out in a very truſty Ballance one Dram of our Impregnated Spirit of Wine, we mixed it with, and ſhook it in as much fair Water as we thought fit, (but not all at once) that is till we had to our Dram of Spirit of Wine, put above fifty times its weight of Water, and that *Alcohol* it ſelf weighing at leaſt two thouſand times as much as the *Noctilucal* Matter, that Impregnated it, it follows, (though it may ſeem ſtrange it ſhould be true,) that the ſingle Grain of *Icy Noctiluca* was able to Diffuſe it ſelf through, and Impregnate full a hundred thouſand Grains of Liquor,

ſo

ſo as (when duly ordered) to make it Luminous. For having preſently after the laſt Water was put into the Glaſs, ſtopt the Veſſel Cloſe with a good Cork, and ſhaken it a little in a dark place, the whole Phial appeared to be full of Light, which though it were not more than ordinary intenſe, yet by reaſon of the Bulk of the Liquor made a glorious ſhew, and diſcovered divers of the Neighbouring Objects. And after we had done ſhaking that Phial, not only the upper part, which was fill'd with Exhalations and Vapours, ſhined like thoſe other Liquid *Phoſphoruſes* formerly mentioned, but what was not obſerved in Them, the Water it ſelf had a Luminouſneſs, though of an inferiour degree, of its whole Maſs, which yet will not keep me from thinking of ſome expedient that may ſatisfie thoſe who may ſuſpect, as I did, that ſome of this Light proceeded from the Exhalations that ſhined through that *Diaphanous* Water, though this did not ſeem the only nor perhaps the chief cauſe of its appear-

ing Luminous, ſince when the Glaſs was ſhaken, the whole Maſs of the Liquor appeared to ſhine, ſo that we could plainly ſee through the ſides of the Veſſel, the Conical Figure of its bottom.

After this, I proſecuted the Experiment a good way further, encreaſing the proportion of the Water to freſh Impregnated Spirit, and I found (what perhaps you will think ſtrange) that one part of the *Noctiluca*, being firſt diſſolved in *Alcohol* of Wine, and afterwards briskly ſhaken into a convenient quantity of Water, rendred Luminous as much Liquor, as upon Calculation amounted to four hundred thouſand times its Weight. And this did not ſeem to proceed from the Irradiation of the Luminous Corpuſcles or Exhalations, ſhining in the empty ſpace at the top of the Glaſs; becauſe the Phial was ſo near fill'd with Liquor, that there was but little room left for Vapours; and becauſe alſo, the Vapours, that did play in that ſpace, ſhined but very faintly,

faintly, and when the Glaſs was at reſt much leſs than a minute of an hour, the Light would reach but a little way downwards in the Water, and yet was there ſo dim, as to be ſcarce diſcernable. Whereas in our Experiment, not only the agitated Liquor appeared Luminous throughout, but the Light was brisk enough, inſomuch that the *Conical* Figure of the bottom of the Glaſs was clearly viſible by the help of it.

But leſt ſome ſhould think, that if this Experiment had been further and further proſecuted, the Luminouſneſs would have ſtill extended to greater and greater quantities of Water, I ſhall add, that when I encreaſed the proportion of this Liquor to the *Noctilucal* Matter, to be diſperſed through it, by putting in near three or four ounces of Water, more than I gueſſed would be convenient, the Luminous Matter ſeemed to be as it were drowned or loſt in ſo much Liquor, for though we gave it much more agitation, than

had in the former Experiments been needful to produce Light, yet no Luminouſneſs at all appeared in the mixture. Wherefore, taking ſome freſh Spirit, and ſhaking it into ſuch a quantity of Water, as I thought it might ſerve to Impregnate, I found by Supputation, that the Luminous Maſs of Liquor, thereby produced, amounted to no leſs, but a pretty deal more, than five hundred thouſand times the Weight of the *Noctilucal* Matter diſperſed through it, which is a viſible expanſion, very much greater, than, I think, has been hitherto obſerved in any Corporeal Subſtance diſſolved in a viſible Liquor, ſince it four times exceeds that expanſion of *Cochineal*, which I many years ſince imparted to the ingenious, and which ſeveral of them have in their Writings, been pleaſed to take notice of, as a prodigious thing; one part of the *Cochineal*, ordered as I there mention, having in that Experiment produced a diſcernable Colour in an hundred twenty five thouſand parts

of

of Water. To what has been ſaid, I ſhall add theſe three Circumſtances, which may encreaſe the ſtrangeneſs of the Experiment.

1. The firſt is, that I here only delivered the manifeſt Impregnation of the Water it ſelf, which is a groſs and tangible Liquor, by the diſperſed Particles of the *Noctilucal* Matter, but have made no eſtimate of the incomparably greater expanſion of the Light, that from the Matter included in the Phial, illuminated the Ambient Air, to a conſiderable diſtance from it, though by reaſon the darkened Room was not great, I was diſabled to make an Eſtimate how far the Enlightened Sphere of Air might have extended.

2. The Second is, that this Experiment was not favourably made, but rather invidiouſly, ſince we purpoſely weighed out ſomewhat leſs of the lucid Matter, and now and then more of the Water, than the preciſe quantities that calculation ſuppoſes,

that I might be ſure the Experiment was made ſeverely enough.

3. And laſtly, upon ſearch I found that the grain of *Icy Phoſphorus*, that was firſt put into the Spirit of Wine, we made uſe of all this while, was not, though after ſo long a time, totally diſſolved; a ſmall Fragment, amounting to about an eighth part, if not more, remaining at the bottom of the Phial; upon which having poured ſome freſh *Alcohol* of Wine, and kept it a while in a little heat, to further the diſſolution, I found That Liquor did, as I thought it would, grow very Luminous, when dropt into common Water, ſo that it ſeemed probable, that if the whole Grain of *Icy Phoſphorus* had been diſſolved at firſt in the Spirit of Wine, it would have Impregnated above ſix hundred thouſand times its weight of Water, ſufficient to make it ſhine.

SECT.

SECT. IX.

I Come now to another way, by which I thought the great Subtilty of parts in our *Noctilucal* Matter might appear with good advantage, and possibly you will think by the success, that I missed not of what I expected from the intended Tryal.

Experiment I.

We carefully weighed out a small lump of our shining Matter, amounting to three Grains, and having purposely broken it into divers lesser Fragments, perhaps six or seven at least, we laid them upon a flat bottom'd Glass, that was broader at the top than the bottom, and shallow too, (not being near an Inch deep) that the Matter might be more fully exposed to the free Air. This Glass we placed in a South Window, laying it very shelving, that the Li-

quor

quor to be produced, by its resolution in the moist Air, might presently run down, and not hinder the free Evaporation of the remaining Matter. In which posture of the Glass, we had also another aim, to be hereafter mentioned. The Vessel being thus placed, about ten of the Clock at Night, all the Fragments of the *Noctiluca* shined briskly, and so continued to do, till most of them were resolved into other Substances, and the biggest of them continued to shine till they were reduced to such a smallness, that they would scarce have been seen, had not their own Light made them visible. But the main thing that I am to take notice of in this Experiment, (and which perhaps will somewhat surprize you,) is, that so little quantity of *Noctilucal* Matter continued to emit visible Fumes for a good many more than an hundred and fifty Hours, and this with Circumstances that made the thing more strange.

1. As First, That this Smoke was not only visible but manifest, and that as

as well in the Night (as I often obſerved from time to time) as in the Day.

2. Secondly, That the ſeveral Parcels of Matter did each emit theſe Fumes all at once, as if it were from ſo many little Chimneys.

3. Thirdly, That this Smoke was ſo Copious, and withall ſo Tenacious, that it would eaſily retain the form of Smoke at a conſiderable diſtance from the Bodies that emitted it, ſo that as I walked to and fro in the Room, a careleſs look towards the Glaſs would often diſcover it to me, and ſometimes it would manifeſtly appear at a diſtance, that I eſtimated to be near a Foot from the Matter that afforded it.

I ſhall now add, to another purpoſe, the following Circumſtances; namely,

1. Firſt, That the motion of the Smoke was ſwift enough, conſidering that it had no Channel or Chimny to aſſiſt it. It *was* not always, nor for the moſt part, directly upwards, but ſometimes Horizontal, ſometimes downwards, ſometimes towards the right hand,

hand, and ſometimes towards the left, as if the motion of the Fumes had been determined by the ſituation of thoſe parts of the *Noctilucal* Fragment, by which they were emitted, and as 'twere diſcharged; I uſe this laſt expreſſion, becauſe taking pleaſure to watch attentively the Circumſtances of our delightful Experiment, I thought, I many times obſerved a kind of Palpitation or Æſtuation in the little ſhining Fragments, which I gathered from the Apparent great inequality I perceived in the plenty of the Smoke, that was emitted at ſeveral times, all of them perhaps within the compaſs of a minute or two. But on this I forbear to diſcourſe, till I ſhall have made further obſervations; and therefore I ſhall proceed to take notice of one Circumſtance more in our Experiment; which is,

2. Secondly, That even in the latter part of it, after the ſhining Matter had been ſo long expoſed to the Air, it emitted a ſmell ſtrong enough; which

which ſeemed to be cauſed by odorous Exhalations, diſtinct from the viſible Fumes.

SECT. X.

AND now 'tis time that I give you ſome account of the reaſon, (that I but pointed at before,) why I choſe ſuch a Glaſs, and kept it in a ſhelving poſture; this I did, that I might not loſe, but preſerve the Liquor, which I knew would fall from the Saline part of the ſhining Matter, which Liquor I thought fit to Examine in order to diſcover certain things; particularly, whether the Limpid Water, as it appeared to be, that was as 'twere the *Cadaver*, or, to employ *Chymical* terms, the deliquated *Caput Mortuum*, of the ſhining ſubſtance, did not yet contain ſomething, as well Luminous as Saline.

Experiment

Experiment I.

To ſatisfie my ſelf about this, I cauſed this Liquor to be put into a ſmall concave Veſſel of carefully refined Silver (that other Salts than *Nitre* and *Allum* might not *Corrode* it) which I had purpoſely provided for the quick Evaporation and Cryſtallization of ſmaller quantities of Matter. Our Liquor, being in this Veſſel put upon ſome ſmall Coals and Aſhes, did not Evaporate near ſo eaſily, as one would have thought, but turned into an *Unctuous* Subſtance, of a dark Reddiſh Colour; wherefore we placed the Veſſel upon quick Coals, that by their brisk heat they might make the Liquor boil, and free it from ſuperfluous moiſture. By this means after a while it was reduced to a Subſtance that afforded us a pretty *Phænomenon*, not unlike to That elſewhere mentioned, where we ſpake of the Infuſion or Solution of the Solid *Phoſpho-*

rus

rus in common Water. For the boiling Liquor crackled like a handful of Bay-Salt caſt into the Fire, and whilſt theſe cracklings continued, (which they did much longer than one would have expected) they imitated little Volleys of Shot, not only in the great number of the Noiſes they made, but in the little flaſhes that accompanied them, which flaſhes, when the Fire was ſomewhat encreaſed, were ſo many, and followed one another ſo faſt, that they appeared to make up a continued flame, not unpleaſant to behold.

Experiment II.

After the foregoing Experiment, I had a mind to be able to make ſome eſtimate, how far the breaking of the ſhining Matter into Fragments, and the conditions of the Veſſel contributed to the quick conſumption of it. To this purpoſe, we took a lump of three Grains, carefully weighed out, and put it into a ſmall Glaſs Funnel,

Funnel, whoſe upper end was wide and capacious enough, in reference to the lower part, which was exceeding ſlender, that the *Noctiluca* might have Air both above and (oftentimes) below, and yet the Matter might not ſlide down, till it were ſo waſted, as to be leſs than a ſmall Pins head; a Veſſel of this ſhape I choſe to make uſe of, that I might catch the Liquor, that would be afforded by the deliquation of our *Icy Phoſphorus*; for which purpoſe the ſlender pipe of this Funnel was put into the Orifice of a ſmall *Cylindrical* Phial, and there kept in a quiet place, which was a South-Window, from whence every Night, after I was in Bed, I cauſed it to be brought into my Chamber, to ſee if it continued to ſhine. By which Tryals, I found that it remained Luminous, and was not yet ſo waſted, to fall quite through the Funnel into the Phial, at ſomewhat beyond the end of the Fifteenth day; ſo that it continued to ſhine, three hundred and ſixty Hours.

The

The very Limpid Liquor, that was brought into the Phial by this Experiment, was unhappily loſt before I could make any Tryals with it, but not before I had done the chief thing I aimed at, in ſaving of it, which was to know its weight to be by and by mentioned.

What has been hitherto related, may juſtly enough make a Man reflect, with ſome wonder, upon the ſtrange minuteneſs and multitude of parts, that are crouded together in our *Noctilucal* Matter; if we conſider what a multitude of Luminous Beams of viſible Smoke, of Odorable, though unſeen, Effluviums, ſo ſmall a quantity of it, as three Grains, which are but the twentieth part of a Drachm, could inceſſantly afford for two or three hundred hours; leaving after all this behind it above three times its Weight, (for ſo we found it to be) of a Liquor, which it ſelf was not a Cadavorous one, or, what it looked like, common Water,

but (as may be argued from what was lately recited of the ſame kind of Liquor) might have been Impregnated with very many Saline parts, and not a few capable of ſhining briskly.

OB-

OBSERVATIONS
About the
INFLAMABILITY
Of the
NOCTILUCA
It ſelf.

SECT. XI.

Obſervation I.

I Took a little of the Conſiſtent *Noctiluca*, and having broken it, and, as its brittleneſs would permit, ſpread it here and there, upon a piece of folded Paper, I lighted that

Paper at the flame of a Candle, and obſerved, that when the flame reached This or That little Fragment of the ſhining Matter, it would take Fire, and burn away in a flaſhing and very ſputtering manner, accompanied with noiſe, almoſt as Grains of Salt *Petre* are wont to do, when they are put upon a live Coal.

Obſervation II.

I obſerved alſo, that if I put pieces of Paper, on which I had placed ſome of theſe Grains of *Noctilucal* Matter, upon ſome Embers covered with Aſhes, before the paper it ſelf took Fire, the ſhining Matter would communicate its flame to the Contiguous Paper.

Experiment I.

We took a Fragment of our ſhining Matter, not amounting to a Grain, This we put into half a Spoonful or leſs of high Rectified Spirit of Wine,

Wine, and kindling that Liquor with the flame of a Candle, the Spirit burned away, as is uſual, in a flame partly Yellow, (and eſpecially at the out ſide) but chiefly Blew: But though the heat of the Silver Spoon, wherein the Tryal was made, did quickly (as might well be expected) melt the *Noctilucal* Matter, and gave it a Globular form, yet it continued at the bottom without manifeſtly mixing with the Vinous Spirits, or conſiderably altering the Colour of their flame: But when the Spirit of Wine was all conſumed, without leaving any jot of Phlegm behind it, the laſt drops coming, when they were actually kindled, to touch the ſhining Matter, preſently ſet it a Fire, but its flame was very differing from that of the Vinous Spirits. For beſides ſomewhat that was odd in its Figure, its Colour was not at all Blew, or Blewiſh, but of an intenſe Yellow, and burned ſo fiercely, and with ſo Vivid a Light, as was ſomewhat ſurpriſing to behold, and continued to Burn a

pretty while, conſidering the paucity of the combuſtible Matter. And whilſt it burned, it emitted good ſtore of Smoke, that ſeemed to be darted up to a conſiderable height, the Matter did not burn all away at firſt, but left a kind of *Caput Mortuum*, which lay in the form of a little Cake, partly of a deep Yellow, and partly of a fine Red. This Matter being more Bulky in proportion to That, That was conſumed, than I thought it likely that ſo little of the *Phoſphorus* ſhould contain of incombuſtible Matter, I proceeded to burn it, as elſewhere will be related after another manner, till there remained but ſome very few light feces, that ſeemed to be of the ſame nature, with Thoſe that are to be mentioned in the next Experiment.

Experiment II.

We took a ſmall Fragment, not amounting to a Grain of the *Noctilucal* Matter, and putting it into a Silver

Silver Spoon, we caſt upon it the Sun-beams concentrated by our ſmalleſt (*Dioptrical*) burning Glaſs; by Theſe it was preſently ſet on Fire, and afforded, together with a great deal of Smoke, a flame exceeding Yellow, and ſo very fierce and bright, that it was conſpicuous; though the Window being purpoſely ſet open, the Beams of the Sun, then in the *Meridian*, were ſuffered to beat full upon it, and a brisk Wind did alſo blow upon it without extinguiſhing it. At the bottom of the Spoon, the expiring flame left a round and broad *Caput Mortuum*, conſiſting of divers Circles, like thoſe of a *Sardonix*, whereof the largeſt was White, another Yellow, and the third Red, all the three Colours being Pleaſant and Vivid enough. Some part of this *Caput Mortuum*, being again brought to be freely touched by the Air, appeared Combuſtible, and the reſt being left in the Spoon, that the Air might work upon it, did for the moſt part ſoon reſolve it ſelf *per Deliquium*

liquium into a Liquor, almoſt as ſharp as Spirit of Salt, the reſt being a light Black Feculency, of which, becauſe there was ſo very little of it, we could make no Examen.

Experiment III.

Being deſirous to try, whether the *Noctilucal* Matter would, by bare preſſure or motion, be brought to Burn, I thought not fit to depend upon ſuch other Experiments, as are here related, wherein it appears able to ſet Fire on divers Bodies, belonging to the vegetable kingdom, or are otherwiſe eaſily inflamable, wherefore we put two Grains of our dryed *Noctilucal* Matter into a Glaſs Morter (furniſhed with a Glaſs Peſtle) whoſe coldneſs and thickneſs were able to keep it from being put into any ſenſible heat by the operation, that was to be performed in it, and conſequently from communicating any heat of *its own* to the *Noctilucal* Matter. This was pretty briskly rubbed in

in the Morter, with the Glaſs Peſtle, but though it was thereby brought to ſhine much more Vividly than before, yet it did not take Fire, which I was apt to impute to the great coldneſs of the Glaſs, which much oppoſed the *Incaleſcence* of the *Phoſphorus*, but after a while longer it took Fire, and began to burn away in an actual flame, with much Smoke: But this did not laſt ſo long, as might have been expected, which ſhort duration might proceed from the Veſſel, that continued ſenſibly cold, and perhaps alſo from the narrowneſs, and depth of it, which ſomewhat hindred the free acceſs of the Air; for ſome Matter, that was taken out on the Peſtle, ſeemed to Burn better, than That which remained in the Morter, which being extinguiſhed, was once more kindled by Trituration, but ſoon expiring again, could not by the ſame means be rekindled, but only was brought to ſhine briskly.

EX-

EXPERIMENTS
About
BURNING
Other
BODIES
With the
NOCTILUCA.

SECT. XII.

I Formerly intimated that our consistent *Noctiluca*, notwithstanding the appearance it had of *Ice*, and its actual Coldness to the touch, was much disposed to have

have its parts easily put into motion, and might by that means be brought to be sensibly hot. And I think it time now to proceed to make this good by particular Instances.

1. And First, If our *Phosphorus* be for any time pressed hard between ones Fingers, or against a Board, or some such hard and not very cold Body, it will oftentimes be felt actually and very sensibly hot, and sometimes the degree of heat will be so vehement, as to Scorch the Skin, as my venturous Laborant found several times to his no small pain, his Fingers being almost covered with Blisters raised on them, by handling our shining Matter, with too bold a curiosity: And he complained to me, that, though according to the usual fate of *Chymists*, he had been often Burned on other occasions, yet he found Blisters, excited by the *Phosphorus*, more painful than others; and he is not the only person that has complained to me of their finding the Burning made with this Matter to

be

be more tedious and difficult to be cured, than ordinary ones. But, as our *Noctiluca* was not always made of the ſame Matter, nor with care equally ſucceſsful, ſo I obſerved its proneneſs to incaleſcence, and the degrees of heat, to which it would be brought by motion, to be differing enough; upon which account, I did not find, that ſome portions of it, would produce thoſe higher effects of heat, that ſome others did, beſides that theſe higher effects did gradually differ among themſelves.

2. Agreeably to this, after having in vain tryed to Fire Paper by preſſing and rubbing ſome of our *Phoſphorus* upon it with the blade of a Knife, I took a piece of fine Paper, and having dry'd, and warm'd it at the Fire, I put a little of our *Noctiluca* in a fold of it, and rubbing the Paper between my hands, though by that attrition there were produced a ſenſible, and even conſiderable heat, yet it did not reach to what I deſired, but continuing a little while to rub

the

the Paper to and fro, it did on a ſuddain take Fire, and blazed out, ſo that it would have Burned my hand, if This had not been kept from receiving *much* harm (for *all* it did not eſcape) by a thin Glove, that was thereby ſcorched, and in part ſhrivel'd up. After the ſame manner, to make the Experiment the more certain, I fired another piece of Paper, but then deſiſted, that I might not unneceſſarily waſte a Subſtance, wherewith I was but meanly ſtored.

3. If the firing of Gun-powder could be performed with our *Phoſphorus*, without the aſſiſtance of Circumſtances, whoſe difficult concourſe will keep it from being more than an inſtructive Curioſity; the fear that it might be applied to uſes miſchievous to Men, would keep me ſilent of the power our *Phoſphorus* may be brought to have of kindling Gun-powder, when 'tis befriended with favourable Circumſtances. To try therefore, whether our *Phoſphorus*, which appeared not inferiour to That of Mr. *Craft*'s, would (as His did ſometimes, though not eaſily)

ly) fire Gun-powder, we took a little of our ſhining Matter, and having a little wiped it, to dry it, we put it upon ſome dry Gun-powder, and with a Knife preſſed it, and in ſome ſort rubbed it upon the Black Grains, but found, that though a heat were produced, and ſometimes ſuch as would make ſome of the *Corns* of Powder have a Blewiſh flame, yet the mixture would not go off: So that the Laborant, to whom I left the care of reiterating the Experiment in my preſence, preſuming it would not ſucceed, ſcrupled not to hold his Head over it, that he might the better ſee what change was made in the mixture; but then upon a ſudden the powder took Fire, and the flame ſhooting up, caught hold of his Hair, which made a Blaze, that proving innocent enough, became more diverting, than the ſmell of the Smoke that ſucceeded it was delightful.

4. But the ſame Laborant, who was very helpful to me in varying the preparation of the *Phoſphorus*, had a worſe

worſe miſadventure not long aſter, for bringing me ſome newly Diſtill'd Grains of our *Noctiluca*, covered with ſome of the ſhining Water, that came over with it, he unluckily broke the Glaſs in his Pocket, whereupon the heat of his Body, encreaſed by the motion his long walk had put it into, did ſo excite the Matter, that was fallen out of the broken Phial, that it Burned two or three great holes in his Breeches, before he could come to me to relate his misfortune, the recent effects of which I could not look upon without ſome wonder as well as ſmiles.

5. Having already told you the effect of our *Noctiluca* upon Gun-powder; I thought fit to try, whether it would not kindle a Bodie, that is thought ſomewhat leſs prone to take fire. And accordingly having put together about half a Grain of our dry *Noctilucal* Matter, and ſix times its weight of common flowers of Sulphur, they were lodged in the fold of a Piece of White Paper which was laid upon a Board, and when I had a little bruis'd *Exper.*

and

and rubb'd This with the Haſt of a Knife, it ſhone through the intercepted Paper very Vividly, but did no more: Wherefore, ſuſpecting that the want of Air was the cauſe why it did but ſhine, not burn too, I opened the Paper, and found that as ſoon as the Air had acceſs, it took Fire and furiouſly Burned the Paper, and, if I had not been wary, had burned me too. Another time, the ſame Experiment being try'd, afforded this notable *Phænomenon*, that the Ingredients, being well rubb'd together in folded Paper, though before the Paper was diſplaid and expoſed to the Air, they did not kindle, yet upon the contact of This, the mixture took Fire, and did not burn away with a ſlow flame, as Brimſtone is wont to do, but flaſhed away at once with a great blaze, like Fired Gun-powder, ſave that the flame appeared more Luminous.

6. The higheſt effect of the heat of our *Icy Noctiluca* was caſually produced by the Laborant, who being deſirous to try, whether ſome that was

was newly prepared was good and fit to be brought to me, began to Write Letters with it, upon a piece of Planck, that had been long uſed in the Laboratory as part of a Stove, and he, chancing to preſs the recent Matter hard upon this Board, that the conſtant heat of the place had brought to an unuſual degree of dryneſs, found to his ſurprize, that he had not only ſhining but burning Letters: The Lucid Matter having actually ſet on Fire thoſe parts of the Wood, againſt which he had ſtrongly preſſed it.

SECT. XIII.

Experiment I.

TO examine ſomewhat particularly, to what Family, or Sort of Salts, the *Saline* part of our *Noctilucal* Matter either does belong, or has moſt cognation with (for I thought it poſſible it might not fully agree with any known *Species* of Salts, but have ſomewhat peculiar to it ſelf) I ſuffered a little of the ſmall ſtock, I then had, to reſolve it ſelf *per Deliquium* into a clear Liquor, and then made with it ſome of the Tryals elſewhere delivered, by which I am wont to examine what *Species* a Salt belongs to, gueſſing this Liquor by the taſte, and the manner how it was made, to be ſomewhat, though not altogether, of the nature of Spirit of Sea-Salt: I dropt a little of it upon a convenient proportion of Syrup of Violets, and found that it turned it not Green, as a Volatile Urinous Salt would have done, but of

of a fine Carnation Colour, ſuch as that Syrup is wont to acquire, upon the mixture of an *Acid* Spirit with it. I found alſo, that a very little of our *Anomalous* Liquor preſently deſtroy'd the blew Colour, and not the other of a Tincture of *Lignum Nephriticum*.

Experiment II.

I alſo put ſome of this Liquor, that came by *Deliquium* from the *Noctiluca*, upon ſome filings of Copper, which being thorowly wetted, and ſome of them covered with it, I expoſed in a hollow Glaſs for two or three Days to the Air: and by this means had, as I expected, without the help of heat, a ſolution of ſome of the Filings of Copper, the Colour of which was not a deep *Azure*, as if it had been made with a Volatile Urinous Salt; but ſeemed to partake of Green and Blew, and to be an intermediate or Compounded Colour.

Experiment III.

To make the Saline nature of this Liquor the more manifeſt, I put ſome

of it upon powder of Red *Coral*, which it presently fell upon, and Corroded with noise and froth; and putting another parcel of the same Liquor, upon some dry Salt of *Tartar*; there presently ensued a fierce conflict between them, whereby some noise and much froth was produced; so that I thought it needless to waste any more of the *Noctilucal* Matter, (wherewith I was but slenderly stored) to make it more apparent, that our Liquor was not, as most *Chymists* would have expected, of an Urinous nature, but belong'd to the Family of *Acid* Salts, and seemed to be near of kin to that branch of them, to which the Spirituous part of common or Sea-Salt belongs.

Experiment IV.

Some Virtuosi may be apt to think, that since our *Icy Noctiluca* is of a more Solid Substance than the *Aerial*, and uses to continue to shine much longer, since I say this is so, if the consistent

Phosphorus

Phosphorus were included in a Glass, whence its expirations could have no vent, the Matter being kept from wasting, the Luminousness may also be kept from ceasing. This conjecture being plausible, though the Notion I have of the Nature of our *Noctiluca*, could not promise me a confirmation of the conjecture, yet, to prevent the being blamed for an easily evitable omission, I put some of our dry *Phosphorus* into a clear Phial, capable, as was guessed, to hold about an Ounce of Water, and having very carefully closed this Glass, I laid it aside, and observed it to continue to shine for some few days, after which the Light manifestly decayed, and soon after quite disappeared, though I thought it possible, that it did not altogether so soon expire, as it ceased to be visible to me; because the Whitish Fumes, emitted by the Matter, whilst it continued to shine, had covered the inside of the Glass, with a kind of Whitish Soot, that at length opacating it, might well

hinder a faint Light from pervading the Veſſel and reaching our Eyes. But it ſeems, that the Air included with the *Phoſphorus*, either had ſome vital Subſtance (if I may ſo call it) prey'd upon thereby, or elſe was by the Fumes of the *Phoſphorus*, to name no other poſſible ways, tamed and rendred at length unfit to continue the flame [*ſui generis*] of our *Noctiluca*.

Experiment V.

Yet to purſue the deſign of making a Light more laſting than ordinary, by keeping the Matter from commerce with the External Air, I took ſome of our *Noctilucal* Matter, that came over with the Aqueous, from which 'twas not ſo eaſily ſeparable, but that I thought it beſt to leave them together, in regard that it ſhone ſo well, that it might paſs for an excellent portion of the *Aerial Noctiluca*: This we Sealed up in a Glaſs-Egg (whoſe bottom had been made flat on purpoſe, that it might ſtand

without

without leaning) and ſetting it in a place, where it would be frequently in my Eyes, I obſerved it from time to time, eſpecially at Night, and found it continue to ſhine (if I much miſremember not) a Week or longer, and that with ſo little decay of Light, that I was ſurpriz'd, when, coming in the Night time to look upon it, I found it to ſhine no more at all, eſpecially ſince I could not reſtore any manifeſt light to it, either by agitation, or by moderately warming the Sealed Glaſs, that contained it.

Experiment VI.

After many Obſervations made of the degrees of Light, that our *Icy Noctiluca* afforded, as 'twere of its own accord, without external heat, I thought fit to try whether by the application of a moderate heat of the Fire, the Light might not be much invigorated, and perhaps the *Phoſphorus* it ſelf be brought actually to kin-

dle, even in a Close Vessel. This Design, I was the rather induced to prosecute, because I had some hopes, that by this way of encreasing the Light of our *Phosphorus*, though it should not long retain its acquired degree of Luminousness, yet this increase might continue long enough for some not inconsiderable uses. And especially (in case much *Noctilucal* Matter were heated at once) to give Light enough for taking of Gun-powder out of the Gun-room of a Ship, or out of a Magazine, without danger of firing the Powder, which would be a means to prevent those sad accidents, that have but too frequently happened to Ships, especially of War, of which we had very lately a notable instance in the River of *Thames*. In prosecution of this Design, we took some Grains of our Consistent *Phosphorus*, and having put them into a round Glass-Egg, somewhat larger than an ordinary Hen Egg, fitted with a stem of a proportionable bigness, and about two thirds of a Foot long. This being

Hermetically

Hermetically ſealed up, (at leaſt as far as we diſcerned) the Globulous part of it was warily, and by Degrees, warmed at the Fire, and then we inſtantly removed it into a dark place, were the included Matter, not only ſhone by great odds more vividly than before it was heated, but ſome portions of it were brought to an actual flame; as appeared both by the radiant Splendor of the Burning Matter, and by the condition of the Smoke, it emitted: And yet more manifeſtly, by the intenſe heat which the flaming part of the Matter (and not the other parts) communicated to that part of the Glaſs, which it adhered to; for there the Veſſel was not to be ſo much as touched without inconvenience; and when this flame expired, which it did after no long time, the portion of the lately kindled Matter did no more ſhine or burn as before, but was reduced to the condition of the reſt of the *Noctilucal* Matter, together with which it did for a good while retain a conſi-

derable

derable degree of Light, upon the account of the heat, it had been expos'd to, over and above that Luminousness that ordinarily belonged to it.

This Experiment appeared so strange, and was so delightful to those that had never seen it, that partly to gratify the curious, and partly to pursue my own design, 'twas reiterated within the compass of a Month or two, between (if I mistake not) twenty and thirty times, the same Matter being still kept in the same Vessel, though by being melted, and in great part sublim'd by its frequent approaches to the Fire, it was divided into several parcels. But this made the Experiment so much the more pleasant, in regard that sometimes (for it was not always) more than one or perhaps than two portions of the Matter would seem to burn at once. This was looked upon as a very new and scarce credible thing, that one should be able to bring a Bodie to Burn with an actual flame; and for no inconsiderable

time,

time, in a Glaſs Hermetically Sealed, and not large neither. But to deal with *Philoſophical* ſincerity, I muſt not conceal from you, that after we had made many Tryals, in the above mentioned Glaſs, there happened a *Phænomenon*, which gave me ſome ſuſpition, that at that time, it was not actually Sealed: But it did not appear, but that it had been very well Sealed at firſt, and might continue ſo during ſeveral Tryals, for after this ſuſpition we uſed this Glaſs ten or twelve times, or perhaps oftner to make the before recited Experiment, and after all thoſe we could perceive no crack or flaw at all in the ball or ſtem of the Glaſs, and found it difficult to get in the point of a ſmall pin into a little hole, which we either found, or, by endeavouring to find one, made at the *Apex*. However, by the things formerly related, it appeared, that our *Noctilucal* Matter would Burn with leſs vent by great odds, than other Jewels known to us, and that a ſmall quantity may be made

made to burn and ſhine longer, than one would expect. And we were encouraged by what we ſaw, to hope that if a more conſiderable quantity of Matter, were put into a conveniently ſhaped Glaſs, and aſſiſted with other friendly Circumſtances, eſpecially if the Luminouſneſs could be a little heightened, it may be rendred fit to be of ſome uſe in Ships, and Magazines of Powder.

If I had been furniſhed with accommodations, when I firſt made the foregoing Experiment, I would have purſued the Tryal ſomewhat further, by making a pretty quantity of our *Noctilucal* Matter, burn ſeveral times, in a thin Glaſs-Veſſel, exquiſitely cloſed with *Hermes* his Seal, that, by weighing the Veſſel in exact Scales, both before and after the accenſion of the included *Phoſphorus*, I might find whether any ponderable parts were ſubtile enough to pervade the pores of the Glaſs, and in caſe they were not, I then hoped to diſcover, what change of texture might be made in the

the Matter of a bodie, reduced to an actual flame, in a Veſſel, wherein it could not receive the free Air, nor emit any Fumes or exhalations, which would have been to me a very acceptable Experiment: And perhaps would have prov'd a very inſtructive one too. Since, as I have in another place complain'd, in the *Analyſes*, hitherto made by *Chymiſts*, either the body expoſed to the Fire, has not been actually inflamed, which is the caſe of Thoſe diſtill'd in exactly clos'd Veſſels, or elſe there has been ſome commerce betwixt Them, and the external Air, which may juſtly render it doubtful, whether the bodies produced by this *Analyſis* were the ſame both for number, nature, *&c.* that would have been produced in Veſſels, exquiſitely cloſed, ſince we ſee that Wood, for Inſtance, burned in a Chimny, affords ſtore of Soot and Aſhes, which are very differing bodies from thoſe that *Chymiſts* obtain from the ſame Wood, Diſtill'd in cloſe Veſſels.

But

But to trouble you no further with what *I would have done*, I ſhall add one Circumſtance, I obſerved, in what *was* done. Namely, That ſometimes there appeared a little Liquor in the Glaſs (whether it conſiſted of ſome Aqueous Particles, that may be ſuſpected to have lain hid in the *Noctilucal* Matter, or were produced by the actual deflagration of a part of the Matter) and the reſt of the Matter by the reiterated operarations of the Fire was turned to a Red Colour, which it yet retains.

SECT. XIV.

Experiment I.

I Have formerly related, that upon the immerſion of our *Phoſphorus* into Water, it would immediately ceaſe ſhining, and continue without Light, as long as 'twas kept under that Liquor. This gave me a ground to ſuppoſe, that, by the interpoſition of Water between the *Noctilu-*

cal

cal Matter and the Air, the *Phosphorus* may be kept unactive, till it be fitted, by an extraordinary agitation of its parts, to act with an unwonted vigour, when the Air shall come to touch it suddenly; this supposition, I say, induced me to put two Grains of our *Icy Noctiluca* into a small Glass Egg, and pour a pretty quantity of Water on it: In order to the following Experiment, we heated the Liquor well, yet without making it at all boil, and thereby melted the little Fragments of Solid Matter, and made them flow into one Liquid Mass, that kept it self at the bottom, distinct from the Water: This done, we presently remov'd the Glass into a dark place, and pouring out the Water, we observ'd, that as soon as the Air came to touch the *Noctilucal* Matter, it seemed to be kindled into an actual flame, that afforded a very Vivid Light, which success pleased me the better, because it shewed, that a kind of Fire may be kept under Water, as long as one pleases, without sensibly

ſibly burning, and yet in a moment, upon the bare removal of the Water, ſhew itſelf in the form of actual Fire. That our ſhining Subſtance was of this nature appeared manifeſtly by this, That the Water, being poured out ſomewhat too haſtily, carried along with it, which I did not intend it ſhould do, the whole Maſs of the *Noctilucal* Matter, and This, by its fall into the Silver Cup, that was employ'd to receive the Liquor, was divided into two or three parts, which coming to a more free or full contact of the Air, blaz'd out much more than when they were in the Glaſs, and afforded us a delightful ſpectacle, ſince the flame burned upon the Water with much Light and fierceneſs, and a ſtrange deal of Smoke, and it did ever and anon, ſputter with noiſe, like Salt Petre made to burn upon a live Coal. Theſe flames continued the pleaſure we had to ſee them burn upon the water a pretty while, and after their extinction, looking into the Siver Cup, we found divers flakes

of

of a Reddiſh Matter, (which the *Chymiſts* would call a *Caput Mortuum*) that lay at the bottom of the Water; and the ſides of the Silver Cup, that were next to that Liquor looked almoſt as if fine Brick-duſt had been ſtrewed upon them.

Experiment II.

Being deſirous to ſee whether, our *Noctilucal* Matter ſhining through a Coloured Glaſs, the Beams of Light would be ting'd in their paſſage, we took two or three Grains of our Matter, and put it into a Phial, of an almoſt Spherical Figure, capable of holding, by our eſtimate, about twelve Ounces of Water; which Phial was made of fine Glaſs, of a very pleaſant Colour, participating of thoſe that are call'd Orange and Aurora: But the Lucid Matter, being ſhut up in this Phial, and carried into a dark Room, did not appear through the Glaſs to be conſiderably altered in Colour; whch becauſe I imputed partly to the ſmalneſs

of the Fragment of the *Phosphorus*, in reference to the capacity of the Vessel, through which it would give no more than a faint Light, I caused the Glass to be considerably heated, and then brought it into the dark Room, I staid for it in, there as soon as 'twas come, the included matter seem'd to be actually flaming, and the trajected Beams of Light appeared of an unusual and glorious Colour, the Light being so considerable, that it made divers Bodies distinctly visible, at a pretty distance from the Glass; and we judg'd that by the help of it a Book of a good Print might have been easily read; but this Light, which was the greatest we had, till then, produced with our *Phosphorus*, did not last long in its vigour, but in a short time gradually decay'd, till it came to little more than the usual splendor of the *Noctilucal* Matter.

Experiment III.

I formerly related, that I could not make such an Experiment, as I successfully

fully tryed with the Oyl of *Cinamon* and the Oyl of *Cloves*, to ſucceed with the Oyl of *Mace*. But now I muſt add, that the little Phial, wherein the *Noctilucal* Matter and that Oyl were included, having been ſet aſide as uſeleſs, I afterwards chanced to caſt my Eyes on it,and to have the curioſity to try, whether or no the unſucceſsful Experiment I had made before, were not one of that kind, which in another Paper I have diſcourſed of, under the name of *Contingent ones*,and accordingly there being a ſomewhat dark corner in the Room, I carried the Phial thither, and although it were yet broad day, I unſtopt it there, and was ſomewhat ſurpriz'd to find the included Matter to afford immediately a vigorus Light, which put me afterwards upon repeating the Experiment at different times, which I did with the like ſucceſs, without being able to determine the cauſe of this odd *Phænomenon*.

Experiment IV.

One Experiment I ſhall now relate, which, though (becauſe it ſeems, as well as the laſt recited, a contingent one, I forbore to ſet down with the reſt) will perhaps be thought more ſingular than any of them.

We had in one of our Receivers, that was but ſmall (ſince it was not judged capable of containing a Gallon of Water) a parcel of our Conſiſtent *Noctiluca*, in which my Laborant told me, that he had met with a *Phænomenon*, that to him who knew nothing of what is related *Sect.* XIV. *Exper.* 1. was very ſurprizing, and ſeemed to appear by chance, ſince he often tryed in vain, to produce it when he pleaſed. This Receiver I took into my cuſtody, and pouring out the common Water, with which the ſplendid Matter was kept covered to hinder it from ſteaming away, we obſerved no other change, than that, upon the removal of the Water and the contact

of

of the Air, the *Noctiluca* would immediately ſhine, and continue to do ſo, till we thought fit to extinguiſh it *pro tempore*, by pouring Water on it again.

This being done in the Morning, I conſidered the following Night, that this *Receiver* having been kept in the Laboratory, which conſtant and ſometimes vehement Fires made a very warm place, 'twas but fit in order to make the Tryal a fair one, to bring the ſhining Matter to as great a warmth, as it had in the Laboratory, where it exhibited the *Phænomenon*, I was deſirous to ſee. Having then cauſed the Receiver, with the Water in it, to be held in a hot place, till the Liquor had attained, by our gueſs, a fit degree of Tepidity, we poured out the Water, and within a minute or two after, by our eſtimate, we had the pleaſure to ſee, that the conſiſtent Matter, notwitſtanding the wetneſs that in probability the Water had left on it, we obſerv'd I ſay, that This wet Matter, upon the contact of the

Air,

Air, took Fire of it ſelf, not without noiſe, and burnt with a manifeſt and actual Flame. But our pleaſure was ſomewhat moderated, though the Experiment was the more aſcertained, by this accident: That, before we could pour in Water to quench the Fire, the violence of the flame had broken the Receiver, which was thick enough, and thrown off a piece above half as broad as the Palm of ones Hand, by which unlucky chance we were hindred from endeavouring to find, as we intended to do, whether we could by repeated Tryals diſcover the cauſe of the appearing contingency of this odd *Phænomenon*, which had far oftner in vain, than ſucceſsfully, been endeavoured to be produced.

This Experiment recalls into my memory a notable *Phænomenon* belonging to that formerly recited (*Sect.* XI. *Exper.* 2.) about the kindling of our *Phoſphorus* with the Sun-Beams, united by a burning Glaſs: For whereas, I there mention, that the *Noctiluca*'

Matter

Matter did not burn all away at firſt, but left a kind of *Caput Mortuum*, which lay in the form of a Cake variouſly coloured, I ſhall now add, that ſo much Matter could not be left unfired, unleſs ſomething hindered its accenſion; we warily turned over the little Cake, with the point of a ſharp Knife, and then the under part, being I preſumed hot, preſently took Fire upon the contact of the Air, and flamed away, till the Matter was almoſt totally conſumed.

The Concluſion.

AND now I have acquainted you with all the chief things, that I have hitherto been able to try, or obſerve about our *Icy Noctiluca*, or ſolid *Phoſphorus*: And though I have been oblig'd to deliver them without any exact Method, yet perhaps their novelty will ſerve to make them acceptable to you. Light is ſo noble a thing, that the matter, our *Phoſphorus* affords it to reſide in, being endued

with

with ſome uncommon qualities, and particularly with a ſtrange and almoſt incredible ſubtilty of parts, I cannot but hope, that, if improvements upon ſuch a Matter were more induſtriouſly attempted, by perſons better qualified for ſuch a Work, than I (eſpecially in my preſent Circumſtances) pretend to be, ſomething would be produced, tending to the diſcovery of the nature, not only of Light, but divers other Bodies, and perhaps alſo, of good uſe to humane life. If ſome unwelcome Circumſtances did not for the preſent diſcourage me, I would contribute my weak endeavours towards ſuch a deſign. For ſometimes I think a Naturaliſts Pen, ought to be like a Merchants Ship, that comes from time to time into Port to reſt, but not always to ſtay there, but to take in new Lading, and re-fit it ſelf for a new Voyage to the ſame or other parts. In the mean time I recommend this Subject to your ſelf, and thoſe excellent *Virtuoſi*, you hold Correſpondence with, whoſe ingenious Attempts to advance true *Philoſophy*, will have, for their good ſucceſs, the hearty wiſhes of

Your moſt Affectionate, and
moſt Humble Servant,

R. B.

FINIS.

A

CHYMICAL PARADOX,

Grounded upon

NEW EXPERIMENTS,

Making it probable,

That Chymical Principles are Transmutable: So that, out of One of Them, Others may be Produc'd.

By the Honourable

ROBERT BOYLE,

Fellow of the *Royal Society.*

LONDON,

Printed by *R. E.* for *B. Tooke*, at the *Ship* in St. *Paul's* Church-yard.

1681.

AN ADVERTISEMENT OF THE PUBLISHER TO THE READER.

THE *Following* PARADOX *having been written in or before the Year* 1680. *was kept in the Author's Hands, that it might come out with the Latin Version of his Treatise, intituled,* The Producibleness of

Chymical Principles, *which is annexed to the Second Edition of His* Sceptical Chymiſt, *printed* 1680. *but ſome unluckie Accidents having kept that Tranſlation from being finiſhed, the Author thought fit the enſuing Paper ſhould accompany his* Icy Noctiluca, *both in* Engliſh *and in* Latin: *Upon this account, he ſent me not only the Diſcourſe, that now comes forth, but ſome other Papers, containing the Minutes taken from time to time, by his* Laborant, *of what occurr'd in the long Train of Diſtillations, on which the following Reflexions are grounded. For, the Reader, whether Forreign or Domeſtick, may here be pleaſed to be advertiſed, once for all, That as the Author hath been pleaſed*

to publiſh all his Works in the Engliſh *Tongue, for Reaſons beſt known to himſelf; ſo the Province of the Tranſlating them into* Latin, *hath been undertaken by others: For, indeed, his Aſſiduity and diligent Attendance on his daily and growing* Experiments, *will not allow him leiſure or opportunity to undertake that Work himſelf; tho otherwiſe if he had a deſire to poliſh any thing in that Tongue, his Pen can command a fluent ſtile. This by the by. But I having returned to the Author both his own Papers, and my Verſion of them, in one Roll, it unfortunately hapned, that before the* Icy Noctiluca *was printed off, there broke out in the Night a great Fire not far from the Author's Lodging, which*

was

was ſo threatning, even after the blowing up of ſeveral Houſes to ſtop it, that, as many others were obliged haſtily to remove their Goods, our Author thought fit by the ſame way to endeavour to ſecure his own Manuſcripts; but did it not ſo ſucceſsfully, but that ſome are yet miſſing; and, among others, the Engliſh *and* Latin *Papers lately mentioned. Notwithſtanding which, the Importance of the Subject, and the Novelty of the Experiments, prevailed with the Author, (to prevent the like miſchance from hapning to what he could retrive concerning them) to communicate them to the Curious, who will, by what I have here related, be enabled to underſtand what he writes at the beginning*

of

Advertiſement.

of that part of the following Paper, which, becauſe it was written after the Fire above-mentioned, and very long after the reſt, he calls his Poſtſcript.

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A CHYMICAL PARADOX.

I Adventured many years ago, in the *Sceptical Chymiſt*, and long after in other Papers, to lay down ſome Reaſons of Queſtioning, *whether* the Fire be the true and proper Inſtrument of Analyzing mix'd Bodies, and do but *diſſociate* their Principles or Ingredients, without *altering* them or *compounding* them anew. But I ſhall now preſent you a diſcovery, that will perhaps make you think the Vulgar opinion of Chymiſts to be leſs fit to be *doubted* of, than *rejected*. The occaſion of making the following Experiments, was afforded me by the complaint of an ingenious Chymiſt, (and great Diſtiller) who told me, that endeavouring to purify an Eſſential Oyl by Rectification, he found

to

to his diſappointment, that he Diſtill'd it four or five times ſucceſſively, yet it ſtill left ſome Fæces, (but much leſs than at the firſt) though he concluded, that if he ſhould undergoe the trouble of diſtilling the Liquor, a few times more, it would come over perfectly pure, without leaving any fæculency behind it. But 'twas more congruous to my *Hypotheſis*, to conjecture, that the *Caput Mortuum* he complained of, was not, (at leaſt after the firſt or ſecond Diſtillation,) a more groſs or *Fæculent part* of the Oyl, ſeparated from the more *pure*; but a *new compound* produced, as other concretes alſo might be, by the operation of the Fire. This conjecture of mine was favoured by ſome Experiments, I had made many years before, and imparted to ſome inquiſitive men, whereby two diſtill'd Liquors were made, barely by their mutual re-actions, to afford great ſtore of an Earthly and very fixed Subſtance. And to the ſame conjecture it was ſuitable, that by obſtinately reitera-

ting

ting the Experiment, the action of the Fire upon the parts of the Body, exposed to it, and their mutual operations and combinations among themselves, and not improbably too, the material concurrence of Igneous particles, might produce, besides Earthly fæces, other Bodies not unlike *those* that pass for the Chymists Principles. How far the event proved agreeable to his *Hypothesis*, will be best gathered from the *Phænomena* themselves, of the Tryals, which I shall proceed to set down a succinct account of, as soon as I have premised, to make way for it, That by an Essential Oyl, Chymists are wont to mean such a fine Oleagenous Liquor, as to prevent Empyreume and fæculent parts, has been distill'd with store of Water in a (*Vesica* or) Limbeck.

We took a pound of Essential Oyl of Anniseeds, which Liquor (we therefore made choice of, because 'tis more easie to discern it, by its self-coagulating property, not to be sophisticated; and having put it into a Glass Retort

of

of a convenient ſize, we cauſed it to be Diſtill'd, (in a Sand Furnace, capable of giving a ſtrong Fire) thirty ſix times, in which train of Operations, the enſuing *Phænomena* were both congruous to our *Hypotheſis*, and in themſelves obſervable.

1. As pure as the Eſſential, or, as ſome *Spagyriſts* ſtile them, the Ætherial Oyls of Vegetables are preſum'd to be, and as confidently as Chymiſts pretend they are, the pure Sulphurs or Unctuous principles of the Bodies that afford them; yet, not only the firſt diſtillation left a Subſtance Black, like Pitch, at the bottom of the Retort, but, at every one of the following Diſtillations, ſuch a Subſtance was either ſeparated or generated.

2. Though after a Diſtillation or two it ſeemed likely, that this Pitchy Subſtance would be found every time leſs and leſs, which made the perſon, formerly mentioned, tell me, that he ſuppoſed within ten or at moſt twelve Diſtillations, in all, if one ſhould make ſo many, this which he lookt upon as

an

an Earthy recrement would be quite ſeparated, and leave the Oyl a moſt pure and Homogeneous Liquor; yet I that (as I formerly intimated) look'd upon this black ſtuff not as a ſeparated Excrement, but generated Subſtance, cauſed the Diſtillations to be repeated till they had attained thrice that number, and not only found that at each time, ſuch a black Subſtance was left; but that now and then a ſubſequent Diſtillation yielded much more of *it* than the precedent had done; which change, from leſs to more, and from more to leſs, was not obſerved only once or twice, but ſeveral times. And though this odd Pitchy Subſtance were towards the latter end found in leſs quantity, than at the beginning, yet the cauſe of that may well be, that the Oyl to be Diſtill'd did ſenſibly from time to time decreaſe in Bulk, partly by reaſon of the receſs of that portion of the Oyl, which could not but be diſſipated and loſt in ſo many Cohobations; and partly, and indeed chiefly, by the loſs of ſo much

much Oyl as was transmuted into Pitch and other Substances.

3. The Oyl appeared in Distillation more fixed or unapt to rise than one would have expected from so fine and light a Liquor, and especially towards the latter end of the Distillations, it was often necessary to employ a scarce credible degree of Fire to elevate all, that was not turned into Pitch.

4. The Liquor did not Distill like a pure Principle or Homogeneous Body, as Quicksilver is wont to do, but first some fine and light Oyl usually came over, after which followed a less volatile Oyl with another Substance or two, and after that, another ascended in a distinct manner.

5. For 'tis to be noted that besides the forementioned black Earth, there were produced by the operation of the Fire divers other Substances, whereof the first was a Waterish Liquor or Phlegm; which, after the Oyl had been exposed to some Distillations, began to grow very troublesome.

troubleſome. For being rarified by the heat of the Fire into large bubbles, the Antipathy, or rather Incongruity, between them and the Oyl, occaſioned a kind of conflict, wherein theſe Bubbles did often ſuddenly break, (uſually not without much noiſe) and ſometimes with ſuch violence, as to ſhake and endanger the Retort; which once, by this conteſt, was actually broken; yet not ſo, but that the Liquors and other products of the Fire were ſaved by the watchful Laborant, and ſeaſonably transferred into a new Retort.

6. Beſides this Phlegm, and the Pitch formerly taken notice of, our operation afforded us from time to time a pretty quantity of a certain Subſtance, which, with ſome not unskilful Perſons, paſſed for a Volatile Salt; becauſe it aſcended to the upper part of the Veſſel, and appeared in a dry form, almoſt like ſhort Needles; and becauſe alſo, it ſeemed to the Laborant, that, like a Salt, it was (part of it at leaſt) diſſoluble in the

Spiri-

Spirituous Phlegm, mentioned in the last Number. But though at first, I inclined to this Opinion, yet having made some few Tryals to examin the truth of it, I was, and still am, a little doubtful, whether this sublim'd Body deserve the name of a true Volatile Salt, though possibly there may be a pretty deal of *that* contain'd in it. For I found the lumps of it, notwithstanding their seeming Sponginess, to sink in common Water, and continue at the bottom of it without manifestly being dissolv'd by that Liquor, (as meer Volatile Salts are wont easily to be) either in the Cold, or by being kept a while in a moderate heat. I found this Substance fusible, like Bees-wax, at the flame of a small Taper, and if a lump of it were kindled thereat, it would burn away, partly with a Yellow flame, and partly with a flame more intensly Blue, than *That* of rectified Spirit of Wine, but it appeared apt enough to go out of it self.

These

Theſe, and ſome other things inclin'd me to look upon our anomalous Sublimate, as a Subſtance, *ſui generis*; but yet ſuch a one, as I ſuſpected to be ſomewhat of kin to a *Sal Volatile Oleoſum*, ſuch as *Camphire* ſeems to be. For our Sublimate riſes without ſtrong Fire, and that in a dry form, and is eaſily enough fuſible; all which I have obſerved in *Camphire*, as well as in Volatile Salts, and our Sublimate will, like *Camphire*, diſſolve in a high rectified Vinous Spirit without at all Colouring the Liquor. And having long ſince found by tryal, that *Camphire* will, though ſlowly, diſſolve in good Oyl of *Vitriol*, and make the Menſtruum look of a Reddiſh Brown; I put ſome of that ſolvent upon our Sublimate, and after having left them ſome hours together, though but in the Cold, the Liquor ſeemed to have diſſolved part of the dry Body, having, by its action upon it, acquired a Brown Colour ſomewhat inclining to Red; and part of this Liquor

being put into a pretty deal of common Water, there ſeemed to Emerge by degrees a dry Body, or *Flores*, which brought into my mind, what I have elſewhere obſerved, when I imploy'd the ſame method, to recover *Camphire* out of Oyl of *Vitriol*. But, as I was lately intimating, thoug I think it not improbable, that our *Anomalous Sublimate* may be nearer of kin to a *Sal Volatile Oleoſum*, than to any of the Chymical Principles; yet I have not hitherto found the reſemblance betwixt *it* and ſuch a Salt, to be compleat enough to make me *Dogmatical* in referring it to any *Chymical Product*, of a known denomination: And therefore, till I be further ſatisfied, I ſhall only add, that this Volatile Salt, or Oily Sublimate, or whatever name it may deſerve, was very pretty to look upon, being glittering almoſt like ſome fine flowers of *Benzoin*; and of this we had, though it were very light, between two or three Drams.

7. Beſides all theſe differing Subſtances, our Oyl of *Anniſeeds* afford-

ed

ed us from time to time, a little quantity of *Spirit*, as we concluded from two or three Signs: *One*, that it came not over with the Phlegm, and yet would mingle with that Liquor, but not with the Diſtill'd Oyl: And *another*, that, as it was more fixed than the Oyl and Phlegm, ſo it roſe latter than they; and not only needed a ſtronger degree of Fire; but, which is chiefly conſiderable, it was uſually obſerved, to come over in white fumes, as many Spirits, that are ſomewhat fixed, are wont to do; which was the more eaſy to be obſerved, becauſe, that being willing to make uſe of the ſame Retort as long as we could, for the greater certainty of the Experiment, and the Pitch being not to be taken out, whilſt 'twas any thing ſoft, becauſe of its cloſe ſticking to the Glaſs, it was thought, to give at the latter end of the Diſtillation, ſo ſtrong a Fire, as, by making the Sand and Retort red hot (or very little leſs hot) would make the Pitch ſo dry and brittle, that it might afterwards be looſened from

the ſides of the Glaſs, and got out in the form of a dry and brittle, though exceeding Black Subſtance. And to the *two* foregoing ſigns I ſhall now add a *third*, that does more clearly evince, that the Subſtance we have been ſpeaking of, was a Spirit: For, though it could not but be very much weakned by being diffuſed through ſo great a quantity of Phlegm, as came over before it, yet its Corpuſcles were ſo many and vigorous, that when I put them upon the powder of *crude Coral*, they preſently began to diſſolve it, and the *Phlegmatick Spirit* did in a trice make a great *Ebullition* with noiſe and bubbles, whether I poured it on the fix'd Salt of *Tartar*, or the Urinous and Volatile Salt of *Sal Armoniack*.

The ſucceſs of this Experiment, being anſwerable enough to what I deſired and expected from it, allow'd me to make divers reflections on it, and particularly thoſe that follow.

And, 1. Our Tryal argues, that a Subſtance, that is looked upon by Chymiſts

Chymiſts as a homogeneous Body, and which paſſes for one of their Principles, (for that is the caſe of our Eſſential Oyl of *Anniſeeds*) may yet be of ſuch a nature, that barely by the further action of the Fire, it may be made to afford a very conſiderable proportion of a Subſtance exceedingly different from that which afforded it. For in our Experiment, we obtained a *Caput Mortuum*, whoſe qualities were quite other, than *thoſe* of Oyl of *Anniſeeds*; ſince it was opacous, black, dry, very difficultly fuſible, and fixt, in ſo ſtrong a degree of Fire, as made the Retort that contained it, and the Sand about it red hot. This Subſtance would lye undiſſolved in a highly Rectified Vinous Spirit, into which Oyl of *Anniſeeds* would readily have diffuſed it ſelf (if they had been a litte ſhaken together) without the help of heat. And though we made the Liquor actually boyle a pretty while, yet moſt of the *Caput Mortuum* continued a black Subſtance, only it diſ-

coloured the Menſtruum, which lookt as if it had rather extracted a Tincture, than made a ſolution properly ſo called. And of this black and Pitch-like *Caput Mortuum*, we had at the end of our Diſtillations, when we weighed the ſeveral parcels altogether, not much leſs (which you may juſtly think ſtrange) than half the weight of the whole Oyl of *Anniſeeds*; this black ſtuff amounting to a pretty deal more than ſeven Ounces. And from hence we may collect, that the *Analyſis*, wont to be acquieſced in by vulgar Chymiſts; is as yet, but an indetermined thing, ſince they have not declared (nor perhaps thought of any ſuch thing) what number of Diſtillations, (whether one or more, or if more then one, how many,) ſhall be made the ſtandard, by which we are to conclude, that a Subſtance, obtained by Diſtillation, is a Chymical Principle.

2. It may be alſo inferred from ſome *Phænomena* of our Experiment, that the Fire, as 'tis wont to be employ'd, is not, as Chymiſts pretend it

to

to be, the true and genuine Inſtrument of the *Analyſis* of Bodies, ſince it does not, as they preſume it does, barely extricate and ſeparate the ſeveral ſimilar Subſtances, that, though concealed and diſguiſed by commixtures with each other, were pre-exiſtent (in the ſame forms wherein they afterwards appear) in the Body expoſed to its operation. For in our caſe the Oyl of *Anniſeeds* is, according to the Chymiſts eſtimate, the *Sulphureous Principle* of the Concrete; and therefore has not any other Principles, eſpecially in any conſiderable quantity, contained in it. And yet, by the bare action of the Fire, this Oyl, which they acknowledge to be a ſimilar Body, is brought to afford three or four other Subſtances, of differing natures from one another.

3. From the two foregoing Obſervations we may likewiſe deduce, That the Fire, at leaſt in divers caſes, may not only *ſeparate*, but variouſly *compound* and *alter*, the parts of a Body expoſed to its action; and there-

by give considering men cause to suspect, that divers Substances, that are presumed to be only *Extricated* or *Extracted* by the operation of the Fire, may be really produced by it.

4. Agreeably to which suspicion, it happens unluckily enough for the Chymical *Hypothesis*; that in our Experiment, the Substances that were obtained, were, a fixt and Earthy Powder, a not inconsiderable portion of Phlegm, a Spirituous Liquor, and a dry Sublimate, a-kin to a *Volatile Salt*: And these, though they all proceed from a Body, that, according to the Chymists *should* not, and indeed, for ought appears, *did* not actually contain any of them before, did yet so resemble in qualities the Earths, Phlegm, and Spirit, that Chymists obtain by Distillation from those Bodies, they look upon as perfectly mixed and compounded, that if they are not the same, they have divers qualities, so like *those*, that entitle what is afforded by confessedly mix'd Bodies to the name of Phlegm or Salt,

or

or ſome other Primordial Ingredient, that the Earth for inſtance, or the (*acid*) Spirit obtain'd in our Experiment, are far leſs differing from the Earth of Blood, or the Spirit of *Amber*, than theſe are from the Earth and Salt of throughly Calcined *Hartshorn*.

5. 'Twill ſcarce be neceſſary to draw ſo obvious a Corollary from what has been already deliverd, as this; That 'tis poſſible, that Chymical Principles (or at leaſt ſuch Subſtances, as a Vulgar Chymiſt, not knowing from what Body they were obtain'd, would look upon, as ſuch) may be made of another.

But though I ſhall not enlarge on this *Corollary*, it will not be amiſs to make one conſiderable Obſervation, that belongs to it. Namely, that *Acid* and *Aqueous* Subſtances, how differing ſoever each of them is from a pure Oyl, may be produced from it, by the action of the Fire. For I found by Tryal, that in that Liquor which the Laborant took for the

Phlegm

Phlegm of Oyl of *Anniſeeds*, there was ſuch ſtore of Acid parts, that (as was above recited) they would readily diſſolve powdered *Coral*, though crude, even in the cold; and would make a great conflict with Salt of *Tartar*, and with that of *Urine*, as ſoon as the Liquor was put upon it. But yet the greateſt part of the Liquor by far, ſeemed to be of an Aqueous nature, which a Chymiſt would call Phlegm; which is a Body that will not mingle with Oyl, and is otherwiſe exceedingly different from Oyl, eſpecially an Eſſential one, (ſuch of that of *Anniſeeds*,) whoſe purity makes it it totally inflamable. And the quantity of the whole Liquor, conſiſting of Acid and Phlegmatick parts, was far from being inconſiderable, amounting to about two Ounces and three quarters. It may alſo be worth while to obſerve, as another thing belonging to our *Corollary*, that the Truth, declared in it, allows us to queſtion, whether it be neceſſary to ſuppoſe with

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the Chymiſts, that Nature has been oblig'd to make proviſion of great quantities of *Primordial* and *Simple* Bodies, and that ſhe is ſolicitous to mix them all together, for the compoſing of a Body, capable of affording by the *Analyſis* or ſeparatory Operation of the Fire, Salt, Spirit, Sulphur, Phlegm and Earth: I will not hence univerſally infer, that there are no ſuch Subſtances, one or more to be found, in any of thoſe Bodies that are called perfectly mixed, antecedently to their being expoſed to the Fire. But this, I think, will follow from what has been delivered, that the pre-exiſtence of ſuch Subſtances muſt be made out by ſome other way, than the bare operation of the Fire; and that the grand Chymical ſuppoſition will not hold in all Bodies, that *what ſimilar Body ſoever is obtain'd by the operation of the Fire from a Concrete, committed to Diſtillation*, was formerly and actually pre-exiſtent in it.

6. And laſtly, our Experiment affords us a conſiderable Argument in

favour of that part of the Corpuſcular, or Mechanical *Hypotheſis*, that teaches, inanimate Bodies to differ from one another, but in the bigneſs, ſhape, motion, contexture, and in a word, the Mechanical affections, of the minute parts they conſiſt of. For in our Experiment, we ſee that Oyl of *Anniſeeds*, which is not only an uniform or ſimilar Body, as to ſenſe, but is judged *ſo* by Chymiſts, upon an *Analyſis* of the concrete that afforded it, is, by having its parts variouſly agitated, ſhak'd, and rubbed againſt one another, and in differing manners broken, aſſociated, and ranged, tranſmuted into four Bodies of ſuch differing natures and qualities, as the Chymiſts principles and Elements are known to be. And this without the help of any true Seed or plaſtick Principle, by the bare operation of the Fire, which *Helmont* calls *the Artificial death of things*, and *the deſtroyer of Seminalities*. And this is the more conſiderable, becauſe, whereas the Ancient

Corpuſ-

Corpuſcularian Philoſophers aſſigned three general ways whereby Bodies may be produced; namely, by the *addition* of new parts, the *dividing*, and ſometimes *taking away* a portion of the former, and the *Tranſpoſition* of the conſtituent parts, in our Experiment, the whole work ſeems to be performed only by what they would have called *Tranſpoſition*, and that guided but by ſo ſimple, impetuous, and unruly an Agent, as the Fire. Unleſs it be ſaid, that divers igneous particles, that penetrated the Glaſs Retort, did ſubſtantially aſſociate themſelves with ſome parts of the Oyl of *Anniſeeds*, and concur with them to compoſe the Pitch-like *Caput Mortuum*; which they will perhaps ſay, that (whatever others may do) I ought to allow as a poſſible thing; after what I have elſewhere written, purpoſely to ſhew, that ſuch a penetration of the Pores of Glaſs, by the Atoms of Fire is not impoſſible. But the Experiment, I have delivered, of the Ponderability of Flame, prove only that

that ſome of its Particles may combine with heavy Bodies, and fix'd in the degree of Fire I expoſed them to; my Tryals having been made upon Tin and Lead. And it will not perhaps be thought likely, that Igneous Atoms ſhould, by their combination with the Particles of an inflamable Oyl, produce an Aqueous Liquor, and that in great quantity; as we lately noted of the *Acid Phlegm* of *Anniſeeds*, amounting to two ounces and almoſt ſix Drams.

Upon the whole Matter, the *Phænomena*, obſervable in our Experiment upon Oyl of *Anniſeeds*, ſeem very congruous to the Mechanical *Hypotheſis*, and very unfavourable to *That* of the Chymiſts. For, whether the Fire be ſuppoſed to have Acted meerly as an Agent, or Efficient Cauſe, or to have alſo concurred as a Material one; it appears, that by changes of Texture, without the Addition of any viſible Parts, or of any Seed, Bodies very differing in Colour, Conſiſtence, Fixity, and divers other

Qualities,

Qualities, may be produced from a Body, not only homogeneous, as to ſenſe, but pure enough to paſs for a Chymical Principle. And, though the ſuſpicion lately propoſed, ſhould be allowed to be Probable, as to the other Products, as well as to the black Subſtance; yet ſtill our Proceſs upon the Oyl of *Anniſeeds* would afford conſiderable Corollaries againſt the Chymical Doctrine, I call in queſtion. For, 1. The Objection we are conſidering, will give wary men juſt ground to ſuſpect, that in ordinary Chymical Diſtillations the Fire is not always to be looked upon as a meer Inſtrument of *Analyſis*; but may in many, if not in moſt caſes, be alſo a material Cauſe of the ſuppoſed Principles, produced by its means; which is quite contrary to the Received Doctrine of the Vulgar Spagyriſts, (who are thoſe, I now diſpute with.) But, not to inſiſt on this Remark, I think our proceſs upon Oyl of *Anniſeeds*, will not ſerve to prove the Paradox propoſed at the beginning of this

Paper;

Paper; ſince, treating of Ingredients Chymically obtainable, I may be allowed to ſpeak of them in the uſual ſenſe of Chymiſts, who ſuppoſe the different Subſtances, obtained from a Body committed to Diſtillation, to be the *Hypoſtatical* Principles, and other Ingredients of it, without ſuppoſing the Fire to do any more than extricate or diſentangle them from one another. So that, *Secondly*, (to conclude at laſt this long Paragraph) our Experiment ſeems to prove the Production of *other* Chymical Principles out of *one*, as validly as *their* Experiments prove, that ſuch Principles are obtained from the Bodies, they call Mix'd. For, whereas the force of the lately propoſed ſurmiſe or objection, lies in this, that the Aſſociation of Igneous Particles hinders the different Subſtances, that our Oyl of *Anniſeeds* afforded us, from being uncompounded Bodies, and therefore from being true Principles, they may for all this have as good right to the Title of Principles, as moſt of theſe

they

they will have us take for ſuch: Since the Atoms of the Fire, may every whit as reaſonably be ſuppoſed, to Aſſociate themſelves variouſly with the Corpuſcles of a Mixt Body, committed to Diſtillation, as with thoſe of Oyl of *Anniſeeds*, and ſo their ſuppoſed Principles will, no more than ours, be free from Compoſition. Nay the advantage in the Compariſon, lyes on our ſide, ſince the different Subſtances, that Chymiſts are wont to obtain from a mixt Body, may be Compounded, not only with Igneous Particles, but with the differing Ingredients of the ſame Body; ſince this in their *Hypotheſis* is a mixt Body; whereas Eſſential Oyl of *Anniſeeds* is by them granted to be a Simple one: And therefore each of its Productions, is compounded with no Extraneous Subſtance, ſave the Corpuſcles of the Fire.

When I had framed the Conjecture, *That from a Chymical Principle, ſeveral differing Bodies might be obtained*

by the meer operation of the Fire; I thought fit to endeavour the Confirmation of it, by making Experiments upon other Diſtill'd Oyles, (for thoſe made by expreſſion, are by Chymiſts themſelves, own'd to be Compounded Bodies,) of Natures different, both from the Oyl of *Anniſeeds*, and from one another. And accordingly, whilſt our Proceſs with this Oyl, which the Chymiſts call Eſſential, and which was drawn from a Vegetable Seed, was carrying on, I took care to have Diſtill'd in the ſame Furnace, *Oyl* of *Turpentine*; which, though drawn from a Vegetable Subſtance differs, very much from Oyl of *Anniſeeds*, as alſo *Oyl* of *Amber*; which, according to Chymiſts, belongs to the Mineral Kingdom: And laſtly, *Oyl* of *Harts-horn*, afforded by a Subject, which (to ſpeak in their Phraſe) belongs to the Animal Kingdom.

POST-

POST-SCRIPT.

THeſe Oyls were committed to the ſame Laborant, that managed the lately mentioned Oyl of *Anniſeeds*; and he accordingly kept a kind of Journal of the number of Rectifications, the Quantities of Pitchy Matter from time to time afforded by them, and divers other *Phænomena*, or Circumſtances, that occurr'd in ſo tedious a Proſecution, as I thought Experiments of ſuch moment deſerved. But, the Papers, containing the Minutes of theſe things, having been unhappily loſt, with divers others, by occaſion of a great Fire, that obliged me after midnight to make a haſty and very diſorderly removal of my Writings, I could never once retrieve the Particulars. And therefore I muſt content my ſelf, to ſet down as much of the Tryals

(which I hope will comprize the moſt ſubſtantial part of them) as by examining my own Memory and the Laborants, and by ſome few other helps, I am able to collect: As ſoon as I have given here one Advertiſement, becauſe I think it was omitted, in the Papers, whence the foregoing part of this writing, was Tranſcribed. The Advertiſement is this; that as well in the precedent, as in the ſubſequent part of this Diſcourſe, I do not take *Chymical Principles* in the ſtrickteſt ſenſe of that Term wherein it is confin'd to Salt, Sulphur, and Mercury; but in the larger acception, wherein the Learned Doctor *Willis*, and divers other Chymiſts (that are not all his *Juniors*) imploy it, when they comprize under it, two Elementary Bodies; as they do when they conſtitute five Principles, (which perhaps might be more clearly call'd *Similar Ingredients*;) in which number they comprize Phlegm and Earth, which other Chymiſts, as well as the *Ariſtotelians* wou

would call Elements, (of the Body that affords them.) Taking then in this whole Writing, the word *Principles* in the larger ſenſe above declared (congruouſly whereunto I uſually call them the *Chymical Principles* indefinitely, not the *Hypoſtatical Principles*, which are accounted but three;) I proceed to the particular Obſervations and Reflections I was going to begin.

Firſt, Then it plainly appears, that two of the three lately mentioned Oyls, namely, the Oyl of *Turpentine*, and the Oyl of *Amber*, and therefore very probably the third alſo, (my deſign being the ſame in all three) were Diſtill'd at leaſt fifty times; for I intended not to ſtop ſhort of that number. And by an Inſcription upon one of the Phials, I found that the Oyl, which the contain'd Liquor was drawn from, had been Diſtill'd one and fifty times: which number exceeds by fifteen, *that* of the Diſtillations formerly mentioned to have

been made of the Oyl of *Annii-ſeeds*.

2. Each of the three other Oyles, (*viz.* that of *Harts-horn*, that of *Turpentine*, and that of *Amber*,) did leave from time to time, in the bottom of the Retorts, whence they were drawn off, a not inconſiderable quantity of Black Fæces, much like thoſe, that were left by the Oyl of *Annii-ſeeds*, and which I have formerly call'd a Pitchy Subſtance: I found in a Superſcrib'd Paper, ſome quantity of this ſtuff left by the Oyl of *Turpentine*, and, though I am not certain, whether it were all the ſtuff of this kind that was afforded by the pound of Oyl we employed, yet it amounted to above two Ounces and five Drams: And if I much miſtake not, the other two Oyls did each of them afford a conſiderable quantity of Black Terreſtrial Matter, though the heedful Laborant obſerved, that the Oyl of *Harts-horn* did ſooner leave off yielding copious Fæces (as I often in this Paper call them, to comply with

with the Chymists Terms, though I assent not to their Notion) than the Oyl of *Turpentine*, or that of *Amber*. But if neither of the two afforded any more, than did the Oyl of *Turpentine*, I look upon it as a remarkable thing, that the Oyl of *Anniseeds*, which is a fine Essential Oyl, Distill'd in a Vesica or Limbeck, should yield above twice more of Earthy Matter, than either of the three other Oyles, that were Distill'd but in Retorts.

3. Of the Colour of the Rectified Oyl of *Harts-horn* I can say little, having unluckily lost the Liquor it self; but the Oyl of *Amber*, after the one and fiftieth Distillation, was indeed very clear, but yet of an *Amber* Colour, that was far from pale: And the Oyl of *Turpentine*, that is usually after one Rectification a clear and Colourless Liquor, after fifty Distillations, appeared almost Red.

4. But

4. But *that* is much more considerable, which I observed in the quantities of the different Liquors, afforded by the long series of our Distillations, for at the end of the process, the remaining Oyl of *Turpentine*, for instance, did not appear to my Eyes to be considerably, if at all, Superiour in bulk to another Liquor, that came over with it in Distillation, and was not true Oyl, for it would readily enough mix with Water, but keep it self in a Mass distinct from the Oyl, and weighed above three Ounces and three quarters.

5. This oddly produc'd Liquor, I looked upon as compounded of Spirit and of Phlegm: For though the latter did so much exceed the other in quantity, that in an expert Chymists Opinion, the whole Liquor passed for Phlegm; yet, I not only judged some parts of it to be Spirits, but found them to be of an *Acid* nature too; since, besides what the tast made

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me ſuſpect, I found that the Compounded Liquor would readily enough begin to Corrode beaten *Coral*, even in the cold, and ſome of it being poured upon good Salt of *Tartar*, preſently made with it a Conflict and Ebullition, not without a hiſſing noiſe and a multitude of Bubbles. So likewiſe the Spirituous Phlegm of *Amber* made a conflict with Salt of Tartar, and diſſolved crude Coral, as other weak *Acid* Spirits are alſo wont to do. This Liquor of *Amber* was not pale, as the Phlegmatick Spirit of Oyl of *Anniſeeds*, was; and *that* lately mentioned to have been obtained from Oyl of *Turpentine* was high Coloured, being of a browniſh Red.

6. I forgot to take notice in due place (and therefore do it in this) that, among other Tryals made to diſcover, that the Spirits afforded by our Oyls were really Acid, we put two ounces of the Spirituous Phlegm of Oyl of *Anniſeeds* (that being the mildeſt

mildeſt Oyl) upon ſome *Minium*; and, having digeſted them a while together, found the Liquor turn'd ſweet, and fit (as we judged) to make *Saccharum Saturni*: And this Liquor (after Filtration through Cap-paper) being gently abſtracted, left in the bottom of the Retort, a thick Honey-like Subſtance, from which (the Diſtillation being continued in the ſame Retort, but with a much ſtronger heat) there came over ſome Liquor, which being in too little quantity to be Rectified, we could not free it from its Phlegm, and therefore did not find it Inflammable; as I gueſſed the Spirituous part would have been after Rectification, in regard the Liquor was exceeding like the *Spiritus Ardens Saturni*, I have elſewhere deſcribed in its peculiar, and very penetrating taſte and ſmell.

7. It may not be unfit to be taken notice of in this place, that, having lighted on two Phials, that I

long

long knew not what was become of, one of which contained ſome of the Oyl of *Turpentine*, and the other ſome of the Oyl of *Amber*, that I formerly mentioned to have been each of them Diſtill'd at leaſt 50 times; I thought fit to try, whether after theſe Liquors had been laid by about a year and half, or longer, they, would after having had ſo long a time to defecate themſelves in, yield ſtill ſuch a black Subſtance, as has been oftentimes mentioned; and having, to ſatisfie my ſelf, cauſed each of theſe Liquors to be again Diſtill'd in a Retort, it left behind it a greater quantity of a black and ſhining Subſtance, than could well have been expected.

8. It may ſeem very odd in it ſelf, and may much ſerve to confirm, what I have elſewhere delivered about the Mechanical Origin of Fixity, as alſo of the Qualities oppoſite to Fuſibleneſs and to Fluidity; that, ſo Volatile and thin a Liquor, as a Chymical

mical and Rectified Oyl, ſhould by the bare operation of the Fire, be brought to yield a great quantity of what looks ſo like Terreſtrial fæces, as our Pitchy *Capita Mortua* did. But this reflection will, I preſume, appear the better grounded, if I add the ſucceſs of one Tryal (among others) that I made, to examine the Terreſtrial Nature of the black Bodies, I am ſpeaking of: For, although many Bodies that will not aſcend, or be diſſipated in cloſe Veſſels, will eaſily be driven away in open ones; yet having put one ounce of the *Caput Mortuum* of the Oyl of *Anniſeeds*, and as much of *that* afforded by Oyl of *Turpentine*, each of them into a diſtinct Crucible, and kept them three hours and a half, or near four hours, in ſuch a heat, as made the Veſſels all the while red hot; though we kept not the Crucibles cloſely covered, but only looſly to keep out the Aſhes, yet we found, when the Veſſels were removed from the Fire, that the contain'd Bodies had

had not at all been brought to fusion, only *that* from the Oyl of *Annifeeds* was in part fomewhat caked together: And notwithftanding, all the heat, they had been expofed to, the Pitchy Subftance of the Oyl of *Turpentine*, retain'd not far from three quarters of its firft weight; and the *Caput Mortuum* of Oyl of *Annifeeds* loft about eighteen grains lefs than *that*.

9. After this we alfo endeavoured to difcover, whether our Pitchy Subftances would afford any Fixt or Alcalifate Salt, as the *Capita Mortua* of moft Bodies belonging to the Vegetable Kingdom, are wont to do. But *though* we kept an Ounce a-piece of the black Subftances, left by the Oyl of *Annifeeds* and that of *Turpentine*, for nine or ten hours, red hot in the Crucibles; yet we found indeed the Bodies very much diminifhed in quantity, but they did not appear at all Calcin'd.

10. Into a couple of Ounces of this laft named Liquor, we put by little

little and little, of much of dry Salt of *Tartar* as it would work upon, as an *Acid*, or (if you pleaſe) till there would no longer be any viſible conflict excited by adding more Salt. The Acid being thus mortified or ſatiated, I intended to draw off all the reſt of the Liquor, and to try with the Phlegm drawn off, whether by cohobating it very ſlowly in a new Glaſs-head and Body, I could not make a farther tranſmutation of the Terebinthinate Oyl, and change, at leaſt, part of this Aqueous Phlegmatick Liquor into a whitiſh Earth. About the poſſibility of which Tranſmutation, and of ſome others alſo, I might here ſubjoyn an account, if, ſince the lately mentioned Fire, I could have found a ſhort diſcourſe, I wrote, to propoſe and examine this grand Phyſico-chymical Probleme, *Whether we ought to admit any other Elements or Hypoſtatical Principles at all, even ſo much as one of the Bodies that are commonly called, mixt?*

FINIS.

ERRATA.

THE *first Advertisement*, page 5. line 18. dele *very*. p. 22. l. 5. read *Immersed*. p. 34. l. 5. r. *Spe-ctators*. p. 40. l. 16. r. *Operation*. p. 125. l. 22. r. *Little*.